

REFERENCE REPORT #38

ALL YOU EVER WANTED TO KNOW ABOUT CARBON TRADING

On July 18, 2007, The National Petroleum Council (NPC) in approving its report, *Facing the Hard Truths about Energy*, also approved the making available of certain materials used in the study process, including detailed, specific subject matter papers prepared or used by the Task Groups and their Subgroups. These Topic Papers were working documents that were part of the analyses that led to development of the summary results presented in the report's Executive Summary and Chapters.

These Topic Papers represent the views and conclusions of the authors. The National Petroleum Council has not endorsed or approved the statements and conclusions contained in these documents but approved the publication of these materials as part of the study process.

The NPC believes that these papers will be of interest to the readers of the report and will help them better understand the results. These materials are being made available in the interest of transparency.

The attached Topic Paper is one of 38 such working document used in the study analyses. Also included is a roster of the Subgroup that developed or submitted this paper. Appendix E of the final NPC report provides a complete list of the 38 Topic Papers and an abstract for each. The printed final report volume contains a CD that includes pdf files of all papers. These papers also can be viewed and downloaded from the report section of the NPC website (www.npc.org).

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All you ever wanted to know about carbon trading, vol 4 pt 1

Until you know everything, you know nothing

- In this note we update our thoughts on CO₂ trading in light of the recent EU NAP2 decisions. It is structured in the form of answers to the main questions we've had from our equity, credit and commodity clients over the past 6 months.
- **What has the EU done?** On November 29 the EU cut the requested 2008-12 CO₂ permit allocations of 9 countries by an average 5% compared to the requests made. Additionally, reduced usage of UN-flexible mechanism (flexmex) permits was allowed, and some loopholes (eg ex-post adjustments and Germany's 4+14) were removed. We believe the EU is taking a more pugnacious approach to phase 2 vs phase 1.
- **What will phase 2 permit allowances be?** If the EU continues its bottom-up calculations in the same ways as for the first 9 countries, the average cut in 2008-12 allocations vs 2005-07 will be around 13%, or 219mt/year. If the EU reverts to its original guidance of "-6% less 2005 over-allocation" the cut will be nearer 155mt. However, with only 45% of the scheme so far decided (and being challenged by some countries) there is still considerable uncertainty. In this report we also identify the emergence of a number of potential CO₂ trading schemes outside of the EU that could absorb some of the relatively low-cost UN flexmex permits.
- **What will the phase 2 price be?** We believe that the CO₂ market is increasingly pricing in the prospect of (a) tighter allowances from the EU and (b) more UN flexmex permits going outside the EU. As indicated in Figure 1, we believe the CO₂ abatement price for our projected 155-219mt/year shortfall is in the order of €20/t, which we continue to use as our core assumption.
- For more information on the key equity-plays on CO₂ trading, please see the accompanying report "Everything you need to know about carbon trading, vol 4 pt 2: Equity trades on CO₂ - We like it clean".

Table 1: UN permits available to cover the EU scheme demand

Mt CO ₂ equiv	EU targets -10% NAP2 vs NAP1	EU repeats average adjustment factor done so far = -13% NAP2 vs NAP1	
EU permit demand	155	219	219
UN permits available	200	200	200
Proportion going outside EU	51%	60%	60%
UN permits coming to EU	98	80	80
UN permits % demand	63%	37%	37%

Source: JPMorgan estimates.

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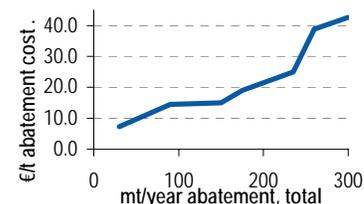
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Figure 1: CO₂ abatement "merit order"



Source: JPMorgan estimates.

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Executive summary

The EU is tightening up phase 2 NAPs, and competition from other trading schemes is emerging for UN credits. We therefore expect to see around 155-219mt of permit "demand" in phase 2, and see the CO₂ price settling at around €20/t long term.

The EU is getting tighter

Table 2: EU permit demand vs flexmex supply

	NAP2 = NAP1 - 10%	NAP2 = NAP1 - 13%
EU permit demand	155	219
UN permits available	200	200
Proportion going outside EU	51%	60%
UN permits coming to EU	98	80
UN permits % demand	63%	37%

Source: JPMorgan estimates.

On November 29 the EU made initial announcements on 2008-12 allocations for 9 countries representing 45% of the ETS (Emission Trading Scheme). It cut allowances relative to requested NAPs by 5%, and tightened up a number of specific issues on: access to UN flexmex permits; ex-post adjustment potential; Germany's "4+14" rule.

If the EU continues its bottom-up calculations in the same ways as for the first 9 countries, the average cut in 2008-12 allocations vs 2005-07 will be around 13%, or 210mt/year.

If the EU reverts to its original guidance of "-6% less 2005 over-allocation" the cut will be nearer 155mt. However, with only 45% of the scheme so far decided (and being challenged by some countries) there is still considerable uncertainty.

Further, we expect more details from the EU in the coming 12 months relating to the post-2012 period, albeit in thematic rather than numeric terms.

Competition from other schemes is emerging

Aside from a harsher attitude from the EU, we also see competition for permits coming from potential trading schemes from outside of the EU.

We are steadily seeing the emergence of trading schemes in the US (RGGI and California) and Australia, and significant government purchases by Japan.

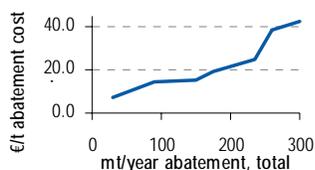
In total these could absorb around 110-120mt of UN flexible mechanism permits ("flexmex", relating to Clean Development Mechanism and Joint Implementation). This is equivalent to around 50-60% of the UN permits available going outside of the EU, acting as a potential support for EU prices.

Permit prices have risen, we see €20/t as a long-term level

The CO₂ market is telling us that phase 1 is effectively a bust – prices have settled in the €6-8/t territory. This is being driven by 2005 over-allocations, warm/wet weather conditions this winter, and the recent block to banking by the EU.

For phase 2, the market has moved to pricing in the €17-20/t territory, driven by the stricter attitude of the EU towards draft phase 2 NAPs. Given the demand for flexmex permits from outside of the EU, and allowing for industrial and utility abatement and in the context of our 155-219mt/year demand assumption we see prices settling at around €20/t in the long term.

Figure 2: CO₂ abatement "merit order"



Source: JPMorgan estimates.

EU NAP2 decisions so far

The EU is clearly taking a tougher line on CO₂ permit allocations for 2008-12 vs 2005-07. We estimate this could equate to a shortfall vs requests of 155-219mt per year for 2008-12. However, we are still a long way from getting enough information to be definitive on allocations vs demand for permits. Individual states will try to fight the EU, but ultimately we do not expect them to succeed. The EU will begin to discuss post-2013 in 2007, perhaps with a view to a single EU allocation plan, but in framework rather than numeric terms.

What decisions did the EU make?

On November 29, 2006, the EU announced its decisions on draft 2008-12 National Allocation Plans (“NAP2”) for CO₂ pollution permits for 10 countries, within the context of the EU's Emissions Trading Scheme. Appendix 3 provides a potted summary of the ETS system.

In aggregate, the EU cut the requested NAP2s by 5.2%, resulting in a cut in NAP2 vs NAP1 (covering 2005-08) of 9.2% and equivalent to a shortfall vs 2005 emissions of 1%.

Table 3: EU NAP2 decisions made on November 29, 2006

CO ₂ kt / year allocations	Phase 2 request by country	Phase 1 actual allocations	% change requested	Phase 2 approval by EU	% change approved vs Phase 1	EU approval vs request by country
Germany	465,000**	499,000	-6.8%	453,100	-9.2%	-2.6%
Greece	75,500	74,564	1.3%	69,100	-7.3%	-8.5%
Ireland	22,640	22,169	2.1%	21,150	-4.6%	-6.6%
Latvia	7,700	4,576	68.3%	3,300	-27.9%	-57.1%
Lithuania	16,600	12,265	35.3%	8,800	-28.2%	-47.0%
Luxembourg	3,950	3,174	24.4%	2,700	-14.9%	-31.6%
Malta	2,956	2,942	0.5%	2,100	-28.6%	-29.0%
Slovakia	41,300	30,502	35.4%	30,900	1.3%	-25.2%
Sweden	25,200	22,876	10.2%	22,800	-0.3%	-9.5%
United Kingdom	246,200	275,500	-10.6%	246,200	-10.6%	0.0%
Total	907,046	947,569	-4.3%	860,150	-9.2%	-5.2%
% scheme reported *		44%				

Source: EU Environment Commission, JPMorgan estimates. * Phase 1 allocations totaled 2.141bn t/a. ** Note Germany had formally requested 482mt, but cut this earlier this week to 465mt

Table 4: EU NAP2 decisions vs 2005 actual emissions and NAP1 levels

CO ₂ kt/a	2005 actual	NAP1	% NAP1 vs '05	EU NAP2 approved	% EU NAP2 vs '05
Germany	474,000	499,000	5.3%	453,100	-4.4%
Greece	71,300	74,400	4.3%	69,100	-3.1%
Ireland	22,400	22,300	-0.4%	21,150	-5.6%
Latvia	2,900	4,600	58.6%	3,300	13.8%
Lithuania	6,600	12,300	86.4%	8,800	33.3%
Luxembourg	2,600	3,400	30.8%	2,700	3.8%
Malta	1,980	2,900	46.5%	2,100	6.1%
Slovakia	25,200	30,500	21.0%	30,900	22.6%
Sweden	19,300	22,900	18.7%	22,800	18.1%
United Kingdom	242,400	245,300	1.2%	246,200	1.6%
Total	868,680	917,600	5.6%	860,150	-1.0%

Source: EU Environment Commission, JPMorgan estimates

Why did the EU make these cuts?

In its decisions the EU outlined a series of both general and country-specific commentary.

General comments

The EU found that most of the NAP2 requests were flawed on a number of grounds. In general, though, the overall maximum level of permits was set on the basis of the formula:

$$\begin{aligned} \text{Phase 2 permits} &= \\ & 2005 \text{ permits} \\ & \text{plus: Country-specific economic growth of between 1.5\% and 5.8\% CAGR} \\ & \text{minus: General technological improvements in carbon intensity of 2.5\% per year} \\ & \text{plus/minus: Country-specific adjustments} \end{aligned}$$

The country-specific adjustments were driven generally by whether the NAP is consistent with the country's Kyoto targets (see Appendix 3), including incorporation of the experiences in 2005 (see Appendix 2). The details of these calculations are shown in table 5 below.

The EU also made comments with regards to:

- **Limitation of the use of UN flexible mechanisms** (ie permits from outside the EU, which we discuss in more detail in the "Importance of UN schemes" section of this report) to a minimum of 10% of the total NAP up to a maximum of 50% of the gap between the country's actual emissions and its Kyoto Protocol target.
- **Banking** (keeping permits from phase 1 for use in phase 2) was basically ruled out on state aid grounds. This was one of the main reasons for the widening contango between phase 2 and phase 1 permits seen since the EU's announcements.
- **Auctioning** (ie selling permits rather than allocating for free) can be implemented ex-post as long as is within the current levels agreed under the NAP1 system. The EU decision document refers to concerns raised by the EU's "High-Level Group on Competitiveness, Energy and the Environment" with reference to the windfall profits being made by utilities currently. This results from the incorporation of 100% of permit prices into power prices despite the utilities typically getting 90–95% of their required permits for free (discussed in the "Get the balance right" chapter of this report).
- In general **more information** on precise installation lists and treatment of new entrants needs to be confirmed. This is important as it means we have a degree of indeterminacy currently in calculating the company-specific impacts of these EU decisions.

In general the language used, and the decisions made, by the EU are a lot harsher than they were for the phase 1 NAPs made in 2004.

Country-specific issues

The EU also made a number of country-specific comments that may prove instructive when determining its views towards the countries where it has yet to make a decision.

- **Germany:** The EU stated that it will block NAPs that have features that guarantee allowances beyond 2012 as being a form of state aid if they are not also applied across all other EU. This relates mostly to Germany's so-called "4+14 rule". Under this, any new plant that replaces an older, dirtier plant gets all the old plant's allocations for four years (ie it would in effect be "over-allocated") and then receive 100% of its theoretical requirements for free for 14 years. Removal of this rule is likely to be the main sticking point in the German government's attitude towards the approved NAP2.
- **Sweden:** In general the EU accepted all the Swedish NAP with the exception of its allowance for UN flexible mechanism permits. These are limited to 50% of required cuts to achieve the country's Kyoto targets. Given that Sweden has already met its required Kyoto target, the theoretical allowance would be zero. However, the Swedish NAP proposed allowing UN permits equivalent to 20% of the NAP in. The EU still wants to encourage UN permits, and therefore applied the minimum 10% allowed.
- **Ireland:** Firstly the EU limited the use of UN permits to 21.9% of the total scheme from the 50% proposed. Second the ability to adjust permit allocations on an ex-post basis was eliminated. Ex-post adjustments had been used by Germany in phase 1, but have actually been barred for phase 2.
- **Greece:** The main country-specific comment from the EU related to the need to remove the ex-post adjustment rule.

What about the decisions yet to be made?

The EU has received notification of allocation plans from a further 8 countries which it has not yet made a decision on, representing 29% of phase 1 allocations. In total these countries are actually requesting a net 2.6% increase in emissions in phase 2 vs phase 1.

We don't yet have a formal date of announcement from the EU for these countries - the EU says simply that "*The assessment of other allocation plans received is underway and will be concluded as soon as possible.*". Under its own rules, the EU is supposed to make a decision within three months of being notified. We'd expect decisions towards the end of December, or more realistically early January 2007.

Table 5: NAP2 notified to the EU, but not yet decided upon by EU

	Phase 2 request by country	Phase 1 actual allocations	% change requested	Date notified to EU
Belgium	63,140	62,054	1.7%	20 September 2006
France	149,700	156,459	-4.3%	To be resubmitted by end Dec
Cyprus	6,450	5,708	13.0%	30 September 2006
Estonia	24,580	18,954	29.7%	16 June 2006
Finland	39,580	45,500	-13.0%	29 September 2006
Netherlands	92,500	88,955	4.0%	26 September 2006
Poland	256,570	238,226	7.7%	23 September 2006
Slovenia	8,299	8,759	-5.3%	6 November 2006
Total	640,818	624,615	2.6%	

Source: JPMorgan estimates

Finally we have the countries for which draft proposals have been made at the national level (and reported in the press) but have not yet been formally notified to the EU. Given this notification was supposed to happen by June 30, 2006, the EU has taken legal action against these countries. Clearly it will be well into next year until

we get more information on these countries. Note that we have yet to see even draft plans for Denmark. Requests for the "refusenik" countries are equivalent to an 8% cut vs phase 1 assuming Denmark is flat period-on-period.

Table 6: NAP2 drafts reported in press, but not yet notified formally to the EU

	Phase 2 request indicated in press	Phase 1 actual allocations	% change phase 2 vs phase 1.
Austria	32,800	33,300	-1.5%
Czech Republic	101,900	97,547	4.5%
Denmark *	33,413	33,413	0.0%
Spain	152,600	182,000	-16.2%
Hungary	30,845	29,925	3.1%
Italy	209,000	222,152	-5.9%
Portugal	33,967	38,166	-11.0%
Total	594,526	636,503	-6.6%

Source: JPMorgan estimates. * Note no press reports of a proposed Danish NAP yet found

What might the final outcomes be?

The EU generated its NAP decisions effectively off the formula detailed in the table below. This starts with 2005 emissions as a baseline, adding the EU's official assessment of economic growth between 2005 and 2010, deducting a standard energy efficiency factor of 2.5% per year and then making a number of (normally small) industry-specific and country-specific adjustments. On average these were -1.3% vs average requests of +4.1%.

Table 7: How were the NAP2 decisions calculated?

CO ₂ , kt equiv	2005 emissions	% growth	% efficiency	2010 Basic allowance	EU adjustments	EU allowed NAP	Requested adjustment	Requested NAP
Germany	474,000	9.6%	-13.1%	457,410	-0.9%	453,100	1.7%	465,000
Greece	71,300	19.9%	-13.1%	76,148	-9.3%	69,100	-0.9%	75,500
Ireland	22,400	27.2%	-13.1%	25,558	-17.2%	21,150	-11.4%	22,640
Latvia	2,900	50.0%	-13.1%	3,970	-16.9%	3,300	93.9%	7,700
Lithuania	6,600	37.4%	-13.1%	8,204	7.3%	8,800	102.3%	16,600
Luxembourg	2,600	27.2%	-13.1%	2,967	-9.0%	2,700	33.1%	3,950
Malta	1,980	11.9%	-13.1%	1,956	7.3%	2,100	51.1%	2,956
Slovak Republic	25,200	32.4%	-13.1%	30,064	2.8%	30,900	37.4%	41,300
Sweden	19,300	16.6%	-13.1%	19,976	14.1%	22,800	26.2%	25,200
UK	242,400	14.3%	-13.1%	245,309	0.4%	246,200	0.4%	246,200
Total	868,680	13.4%	-13.1%	871,561	-1.3%	860,150	4.1%	907,046

Source: JPMorgan estimates. European Commission report from 29 November 2006

If we apply a similar analysis to the countries that have yet to report, applying the same average adjustment of -1.3% we arrive at a situation where (on average) the EU would cut emission allowances for the remaining countries by 16% vs phase 1 and by 14% vs requested / rumoured schemes.

In aggregate this would entail total phase 2 allocations being 12.9% below phase 1, and 10% below requests, generating a shortfall of 285mt vs phase 1 allocations and 219mt vs phase 2 requests.

Table 8: Potential NAP2 under EU guidelines assuming average -1.3% adjustment factor

	2005 emissions	% growth	% efficiency	2010 Basic allowance	EU adjustments	EU allowed NAP	% ch vs phase 1	% vs Requested phase 2
Belgium	55,314	11.5%	-13.1%	54,426	-1.3%	53,719	-13.4%	-14.9%
France	131,238	11.0%	-13.1%	128,417	-1.3%	126,747	-19.0%	-15.3%
Cyprus	6,671	21.1%	-13.1%	7,203	-1.3%	7,110	24.6%	10.2%
Estonia	12,622	49.7%	-13.1%	17,238	-1.3%	17,014	-10.2%	-30.8%
Finland	33,052	13.7%	-13.1%	33,248	-1.3%	32,816	-27.9%	-17.1%
Netherlands	80,351	13.7%	-13.1%	80,828	-1.3%	79,778	-10.3%	-13.8%
Poland	121,542	26.4%	-13.1%	137,728	-1.3%	135,938	-42.9%	-47.0%
Slovenia	8,704	24.6%	-13.1%	9,706	-1.3%	9,580	9.4%	15.4%
Austria	33,373	11.0%	-13.1%	32,655	-1.3%	32,231	-3.2%	-1.7%
Czech Republic	81,119	25.8%	-13.1%	91,434	-1.3%	90,245	-7.5%	-11.4%
Denmark **	26,469	11.5%	-13.1%	26,044	-1.3%	25,705	-23.1%	-23.1%
Spain	181,063	17.6%	-13.1%	189,257	-1.3%	186,797	2.6%	22.4%
Hungary	25,853	14.2%	-13.1%	26,150	-1.3%	25,810	-13.8%	-16.3%
Italy	221,395	7.2%	-13.1%	208,330	-1.3%	205,622	-7.4%	-1.6%
Portugal	36,413	8.8%	-13.1%	34,845	-1.3%	34,392	-9.9%	1.3%
Total	1,055,179	15.2%	-13.1%	1,077,511	-1.3%	1,063,504	-15.7%	-13.9%
Total including decisions made	1,923,859	14.4%	-13.1%	1,949,073	-1.3%	1,923,735	-12.9%	-10.2%

Source: JPMorgan estimates. ** Note that Denmark has not proposed a NAP yet, nor have we seen any press reports.

Table 9: Projected EU allowed NAP2 vs allocated NAP1 and requested NAP2 assuming average -1.3% adjustment factor

	Projected EU NAP2	Allocated NAP1	Projected Shortfall in EU NAP 2vs NAP1	Requested NAP2	Projected shortfall in EU NAP2 vs requested NAP2
Belgium	53,719	62,054	-8,336	63,140	-9,421
France	126,747	156,459	-29,712	149,700	-22,953
Cyprus	7,110	5,708	1,402	6,450	660
Estonia	17,014	18,954	-1,940	24,580	-7,566
Finland	32,816	45,500	-12,684	39,580	-6,764
Netherlands	79,778	88,955	-9,177	92,500	-12,722
Poland	135,938	238,226	-102,289	256,570	-120,632
Slovenia	9,580	8,759	822	8,299	1,281
Austria	32,231	33,300	-1,069	32,800	-569
Czech Republic	90,245	97,547	-7,302	101,900	-11,655
Denmark **	25,705	33,413	-7,708	33,413	-7,708
Spain	186,797	182,000	4,797	152,600	34,197
Hungary	25,810	29,925	-4,115	30,845	-5,035
Italy	205,622	222,152	-16,530	209,000	-3,378
Portugal	34,392	38,166	-3,774	33,967	425
Total	1,063,504	1,261,118	-197,614	1,235,344	-171,840
Total including decisions made	1,923,654	2,208,687	-285,033	2,142,390	-218,736

Source: JPMorgan estimates.

Are we being too pessimistic?

We'd see this as potentially being too pessimistic assessment. Remember the EU indicated in its initial NAP2 guidance notes in January 2006 that average cuts of 6% vs phase 1 would be appropriate. However, this was before it emerged that there was a 4% over-allocation in 2005.

As a consequence, it might be more reasonable to assume that the EU would look to "bend" the system to achieve an overall 10% cut – this would entail an average "adjustment factor" of nearer +4.6% vs the -1.3% in the countries announced so far.

Even this apparently generous approach (only Lithuania and Malta in the initial decisions were given over 4%) the EU will still look to cut requested allowances by 8.8% for the remaining countries. This would entail a shortfall in NAP2 permits vs NAP1 of 221mt, and a shortfall vs requested NAP2 permits of 155mt.

Table 10: Potential NAP2 under EU guidelines assuming average +4.6% adjustment factor

	2005 emissions	% growth	% efficiency	2010 Basic allowance	EU adjustments	EU allowed NAP	% ch vs phase 1	% vs Requested phase 2
Belgium	55,314	11.5%	-13.1%	54,426	4.6%	56,930	-8.3%	-9.8%
France	131,238	11.0%	-13.1%	128,417	4.6%	134,324	-14.1%	-10.3%
Cyprus	6,671	21.1%	-13.1%	7,203	4.6%	7,535	32.0%	16.8%
Estonia	12,622	49.7%	-13.1%	17,238	4.6%	18,031	-4.9%	-26.6%
Finland	33,052	13.7%	-13.1%	33,248	4.6%	34,778	-23.6%	-12.1%
Netherlands	80,351	13.7%	-13.1%	80,828	4.6%	84,547	-5.0%	-8.6%
Poland	121,542	26.4%	-13.1%	137,728	4.6%	144,064	-39.5%	-43.9%
Slovenia	8,704	24.6%	-13.1%	9,706	4.6%	10,153	15.9%	22.3%
Austria	33,373	11.0%	-13.1%	32,655	4.6%	34,158	2.6%	4.1%
Czech Republic	81,119	25.8%	-13.1%	91,434	4.6%	95,640	-2.0%	-6.1%
Denmark **	26,469	11.5%	-13.1%	26,044	4.6%	27,242	-18.5%	-18.5%
Spain	181,063	17.6%	-13.1%	189,257	4.6%	197,963	8.8%	29.7%
Hungary	25,853	14.2%	-13.1%	26,150	4.6%	27,353	-8.6%	-11.3%
Italy	221,395	7.2%	-13.1%	208,330	4.6%	217,913	-1.9%	4.3%
Portugal	36,413	8.8%	-13.1%	34,845	4.6%	36,448	-4.5%	7.3%
Total	1,055,179	15.2%	-13.1%	1,077,511	4.6%	1,127,077	-10.6%	-8.8%
Total including decisions made	1,923,859	14.4%	-13.1%	1,949,073	2.0%	1,987,227	-10.0%	-7.2%

Source: JPMorgan estimates. ** Note that Denmark has not proposed a NAP yet, nor have we seen any press reports.

Table 11: Projected EU allowed NAP2 vs allocated NAP1 and requested NAP2 assuming average +4.6% adjustment factor

	Projected EU NAP2	Allocated NAP1	Projected Shortfall in EU NAP 2vs NAP1	Requested NAP2	Projected shortfall in EU NAP2 vs requested NAP2
Belgium	56,930	62,054	-5,124	63,140	-6,210
France	134,324	156,459	-22,135	149,700	-15,376
Cyprus	7,535	5,708	1,827	6,450	1,085
Estonia	18,031	18,954	-923	24,580	-6,549
Finland	34,778	45,500	-10,722	39,580	-4,802
Netherlands	84,547	88,955	-4,408	92,500	-7,953
Poland	144,064	238,226	-94,163	256,570	-112,506
Slovenia	10,153	8,759	1,394	8,299	1,854
Austria	34,158	33,300	858	32,800	1,358
Czech Republic	95,640	97,547	-1,907	101,900	-6,260
Denmark **	27,242	33,413	-6,172	33,413	-6,172
Spain	197,963	182,000	15,963	152,600	45,363
Hungary	27,353	29,925	-2,572	30,845	-3,492
Italy	217,913	222,152	-4,239	209,000	8,913
Portugal	36,448	38,166	-1,718	33,967	2,480
Total	1,127,077	1,261,118	-134,041	1,235,344	-108,267
Total including decisions made	1,987,227	2,208,687	-221,460	2,142,390	-155,163

Source: JPMorgan estimates

That's great, but what's the bottom line?

We believe that average "cuts vs requests" are going to run at around 9-14% for the remaining countries that the EU will report on, generating a **shortfall vs requests of 155-219mt in aggregate per year.**

The burning question, of course, is what the actual demand for permits might be. **Given that 2005 was over-allocated** to the tune of 94mt (see Appendix 2 for more details) this might suggest the **155-219mt shortfall vs requests is the maximum "demand" level also if governments have repeated their apparent "gaming"**. **However, we would wait until seeing 2006 data and final NAP2 approvals for all countries before being too definitive in this regard.**

Can the states fight the EU? Can they win?

Under EU Directive 2003/87/EC, which established the ETS for phases 1 and 2, there's theoretically a split between EU and national competency on allocations.

The overall NAP, according to Article 9.3 of the Directive, is within the control of the European Union:

“Within three months of notification of a national allocation plan by a Member State under paragraph 1, the Commission may reject that plan The Member State shall only take a decision under Article 11.2 if proposed amendments are accepted by the Commission.”

However, the aforementioned Article 11.2 makes it clear the detailed allocations are under the control of the individual countries:

“For the five-year period beginning 1 January 2008 ... each Member State shall decide upon the total quantity of allowances it will allocate for that period and ... This decision shall be taken at least 12 months before the beginning of the relevant period and be based on the Member State's national allocation plan developed pursuant to Article 9 ... taking due account of comments from the public”

The bottom line, then, is that it is up to local governments to allocate the permits, and the EU would then have to challenge any deviations from the NAPs through the courts. Put another way, **it's more a case of “can the EU fight the states, and can they win”?**

So far, the only vocal objection has come from Germany, which saw cuts even beyond its initially revised offer. The German Economics Ministry has already stated that it (according to Point Carbon, December 1 2006) *“is ready to face a lawsuit from the EU as it does not plan to implement the EU changes”*.

Given that the decision on allocations is supposed to be taken “12 months before the beginning of the relevant period” we'd expect any further complaints to emerge by January 2007.

However, given that the EU has not approved (or indeed received) all the NAPs yet, we see a good chance that the EU may end up having to fight "ex-post" court cases once phase 2 has actually started.

Ultimately, however, we believe that once the overall NAPs have been set by the EU, it will not be possible for the countries to allocate more permits on a sustainable basis.

What about post 2012?

On November 13, 2006, the EU launched a review of the ETS as it stands, with a view to formulating a new Directive to cover the post 2012 trading periods.

The EU anticipates that the full report will be published by the European Climate Change Programme (ECCP) by June 30 2007. The EU then plans to issue a new draft directive during 2H07.

In effect, the EU is looking in this report at four areas:

- **Scope of the ETS:** The EU would like to include other greenhouse gases within the scheme, as well as just CO₂. The EU will separately look at bringing other sectors into the scheme – notably aviation where an initial view should be published by the EU as soon as December 20, 2006.
- **Harmonisation and predictability:** Given the problems faced so far by the divergent contents of the countries NAPs, the EU will look at moving to a standard NAP. Indeed, mention is made of having a single EU-wide cap on emissions, which would be a natural precursor to a single EU-wide allocation plan. It also appears that the EU would like to extend the trading periods beyond the 5 years currently set in the Directive to encourage long-term investment.
- **Robust compliance and enforcement:** So far there is a lack of consistency in checking up on emitters. The EU would like to improve this – again we'd look for a move to a single EU-wide scheme.
- **Involving third countries:** As discussed in the next chapter, there are other trading schemes potentially being set up elsewhere in the world, and the EU would like to potentially link these to the EU scheme.

Overall, then, we expect the EU to talk in some detail over the coming 12 months about the post-2013 period as potentially bringing a single, unified EU scheme, which would remove the elements of national-interest that currently exist.

We would not, however, expect any numbers on allocations to emerge for post-2013 because (as discussed below) the post-Kyoto commitments have not been set yet.

The importance of the UN schemes

The EU looks set to let c200mt/year of permits in from outside the ETS to cover our identified 155-219mt/year shortfall vs the proposed NAP2. We estimate that, adjusting for potential demand from other countries including the US and Japan, around 80-100mt of supply might be available at a price of €10/t or less. Long term we expect to see a global (or at least multi-regional) trading scheme emerge, but this is a post-2012 concept.

What is the relevance of the UN schemes?

Under the "Linking Directive" (Directive 2004/101/EC) the EU allows the use of emission permits generated from the United Nations' "Clean Development Mechanism" and "Joint Implementation" (known as "Emission Reduction Units schemes within the ETS). These are known as Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) respectively. These are a subset of a broader range of "flexible mechanisms" (or flexmex) allowed under the Kyoto Protocol.

The UNFCCC has currently approved c680mt of CDM permits that could be delivered into the EU scheme by 2012, to which can be added c320mt of JI permits – ie up to 200mt/a of permits are available from outside of the EU.

This compares to an implied demand of around 155-219mt/year as calculated above. Given that the "cost" of these credits is probably <€10/t, it is clear why the EU wants to limit their access to the EU ETS.

How many UN permits are allowed into the EU scheme?

In its "Further guidance on allocation plans for 2008-2012" (December 22, 2005) the EC noted that the original Directive stated:

"The plan shall specify the maximum amount of CERs and ERUs which may be used by operators in the Community scheme as a percentage of the allocation of the allowances to each installation. The percentage shall be consistent with the Member State's supplementarity obligations under the Kyoto Protocol and decisions adopted pursuant to the UNFCCC or the Kyoto Protocol."

Supplementarity in this case refers to the UN's "Marakesh Accords" that state "the use of the mechanisms (ie CERs and ERUs) shall be supplemental to domestic action".

The EU then, in its November 29 decisions, stated that it saw 10% as being a reasonable minimum level of allowed CERs/ERUs, but that maximum levels would be set according the supplementarity principle in a strict manner less any permits being bought by the local governments.

This resulted in cuts in the allowed level of CERs/ERUs in Ireland from 50% of the scheme to 21% and in Sweden from 20% down to 10%.

We might see further limitations on CERs/ERUs going beyond this point however, as applying this “minimum” of 10% of scheme size would suggest around 192-197mt of permits might be allowed in – which is within the range of the 155-219mt shortfall in allocations vs requested permits identified so far.

Can the UN permits go anywhere else than the EU?

We are beginning to get further news flow from different countries with regards to the implementation of pollution permit trading. These nascent schemes could represent alternative homes for the UN sourced permits, reducing the flow into the EU scheme. In general, these may have some impact on the back-end of the 2008-12 period, but a bigger impact on the post-2012 period.

California – possibly 47mt/year of demand from 2011

On September 27, 2006, the State of California (the world’s 12th largest emitter of greenhouse gases) implemented law AB-32, designed to establish a “*first-in-the-world comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effect reductions of greenhouse gases*”.

The macro aim of AB-32 is to reduce GHG emissions by 25% by 2020 based on 1990 emissions and by 80% by 2050, starting with mandatory caps from 2012. The aim of the act is to implement a plan to achieve these aims by January 2009 that would take effect by 2011.

As indicated in the table, in order to meet the 25% reduction target, California needs to reduce its emissions by 139.9mt of CO₂ equivalent between 2002 (the last available data) and 2020. Presuming that California follows the Kyoto “supplementarity” rule, it could source up to 69.9mt from outside the state, presumably including UN schemes.

Table 12: State of California GHG emissions, excluding electricity imports

	1990	2002	2020	"Effort"	50% of "Effort"
GHG emissions - mt CO ₂ equiv	360.6	410.3	270.5	-139.9	-69.9

Source: US Environment Protection Agency, JPMorgan estimates.

However, whilst California has set an overall GHG reduction target, the specifics of implementation are left entirely up to the California Air Resources Board (CARB). It is perfectly possible that the CARB might try to implement a solution that is not amenable to permit trading – eg by imposing further emission standards on cars, rather than on limiting the output of power stations. Nonetheless, should a cap-and-trade scheme be implemented, California could act as a “draw” for up to 70mt/year of UN flexmex credits.

US North East / Mid-Atlantic (RGGI) possibly 22mt/year of demand from 2009

Regional Greenhouse Gas Initiative (RGGI, pronounced “reggie”) aims to “*implement a multi-state cap-and-trade program with a market-based emissions trading system*”. Following a set of agreements on December 20, 2005, RGGI was implemented in seven states in the north-east and mid-Atlantic of the US. The main focus of the scheme is the emissions from electricity generating plants.

On August 15, 2006, the RGGI issued a “model rule” that will form the basis of state regulatory rules necessary to implement a cap-and-trade scheme that will achieve a stabilization of emissions at current levels between 2009 and 2015, followed by a 10% reduction 2015-19. The initial cap is 121.2m short tons (109mt) of CO₂ per year. It’s worth noting, however, that none of the States has actually implemented this rule yet into law.

In some regards RGGI’s plans are likely to be harsher than those in the EU scheme – for example on December 6, 2006, the State of New York issued a preliminary regulation that, starting in 2009 once it is ready to issue permits, all permits should be issued for free. That said, some of the costs associated with buying these permits is likely to end up in the utilities’ rate bases – as a result the marginal impact on the groups’ economics are likely to be the spread between allowed and market prices, assuming there is no direct pass-through.

Interestingly, RGGI’s system will allow emission offsets from outside of North America if the emission permit price rises above \$10/permit (2005 money, inflated by CPI+2% pa) capped at 20% of each generators emissions. This provides an obvious arbitrage point between the EU and RGGI schemes, as illustrated in the table below. Assuming the cap is triggered we could see RGGI demand for ETS permits in the order of up to c22mt (ie 109mt x 20%) per year as a maximum.

Table 13: Comparing RGGI international trigger level to EU ETS pricing

€/t	2005 avg	2006	2007	2008	2009	2010
RGGI international trigger \$/short tonne	10.0	10.4	10.8	11.3	11.7	12.2
RGGI international trigger - €/t	8.3	8.6	9.0	9.4	9.7	10.1
EU ETS permits	15.1	6.8	7.5	18.6	19.0	19.6

Source: JPMorgan estimates.

A problem for RGGI (and indeed California) is that the authority of states to regulate the import of electricity is somewhat dubious from a legal perspective. If, in a deregulated environment, a large manufacture buys power from a producer in (say) Pennsylvania, then the NY State authorities cannot regulate the transaction. As a result, generators may choose to move production out of RGGI / California and into non-regulated states. This type of “leakage” (albeit limited in scope) will tend to devalue permits over time.

The rest of the US – several legal and new political routes to follow

In aggregate, the US emits around 7,067mt/year of GHGs in CO₂ equivalent, making it arguably the most significant gap in the potential for global CO₂ trading. As outlined in recent JPMorgan research (“*Liability for Climate Change*”, November 29, 2006) there are two significant court cases going on that are attempting to jump start a process of nationwide greenhouse gas controls:

- **Massachusetts vs EPA:** This is being held by the Supreme Court and concerns Section 202(a)(1) of the Clean Air Act. This statute requires the US Environmental Protection Agency to set standards for motor-vehicle emissions that “may reasonably be anticipated to endanger public health or welfare”. Massachusetts wants the court to order the EPA to set such standards for carbon dioxide and other greenhouse gases. The court probably cannot get to that result unless it finds first that carbon dioxide is a pollutant within the meaning of the

Clean Air Act. Such a finding would undercut the Bush Administration's contention that it has no authority to regulate greenhouse gases, and would lend support to other legal attacks. The first hearing by the Court was held on November 29, 2006, but further progress is unlikely for several months and indeed could easily result in the case being thrown out.

- **Connecticut vs American Electric Power:** This is being held before the US Court of Appeals for the Second Circuit in New York. It alleges that five electric generating companies have created a public nuisance by emitting large amounts of carbon dioxide. The plaintiffs, eight states and New York City, claim that this alleged nuisance is actionable under federal common law rather than under a specific statute. They ask the court to impose an unspecified cap on the defendants' emissions of carbon dioxide, and do not request monetary damages. The US district court ruled for the utilities, holding that the case presents a political question that cannot be decided in court.

Clearly we're a long way from either of these emerging as a cap on emissions, let alone a cap-and-trade scheme, but they perhaps illustrate the multi-directional nature of the pressure to regulate GHGs.

From a political perspective, there is a lot more than just Al Gore going on:

- Senator Kerry introduced bi-partisan legislation looking for a freeze on GHG emissions and potentially a cap-and-trade scheme into the US Senate on October 10, 2006.
- On October 16, 2006, Governor Schwarzenegger of California and Governor Pataki of New York inked an agreement to link California's scheme to RGGI (see details of each scheme above).
- Senators McCain and Lieberman said on November 17, 2006, that they will reintroduce their proposed bill that seeks to set mandatory limits on GHG emissions and a national trading scheme in next year's Congress.

Given the newly Democratic complexion of the House and Senate, and given there are Presidential elections in November 2008 (which are likely to have an environmental slant) it may be that a political outcome is reached more quickly than a lawsuit based one.

For further information regarding the potential emerging US carbon markets please see the recent reports from our US analyst Marc Levinson "*Warming to rules on climate change*", September 27, 2006, and "*Liability for climate change*" November 29, 2006.

Other countries – more coming, but slowly?

Over time we are convinced that more and more CO₂ trading schemes will appear, and that these will act as competition for the EU and US schemes with regards to accessing UN permits. However, these are likely to take quite some time to emerge – possibly by 2010-12, but more likely not until post 2012. We look at three of the most significant potential players:

- **China (3,650mt CO₂ equiv in 1994)** – China is second only to the US in terms of GHG emissions. On September 1, 2006, the government announced that it will launch a scheme to make power plants pay to emit Sulphur Dioxide. We wouldn't

see it as impossible that China might look to move onto CO₂ in the future, and possibly implement a trading scheme also.

- **Japan (1,355mt CO₂ in 2004):** So far Japan has set aside €103m equivalent for 2007 to purchase UN credits – ie c5-10mt per year. The country has also toyed with trading scheme concepts in the past, but has more recently focused on carbon taxes instead.
- **Australia (529mt CO₂ equiv in 2004)** – Several states proposed a national CO₂ trading scheme in August, and Prime Minister Howard in mid November launched a taskforce to consider the best routes to a trading scheme for the country as a possible precursor to a broader Asia-Pacific scheme. Clearly, whilst proceeding with good intentions, Australia is a long way from launching a scheme.

That’s great, but what’s the bottom line?

We believe that we will, eventually, see the emergence of a global (or at least multi-regional) GHG cap-and-trade scheme. However, this is clearly a post-2012 proposition.

In the meantime, given Japan can take c10mt per year from next year at €10/t, RGGI could take 22mt of emissions at a price well below the current EU ETS post 2009, California as much as 70mt from 2011 before counting potential from other US states, Australia or China we’d see at least 50% of UN permits going to other schemes.

Assuming that 50-60% of UN permits go to other schemes for 2008-12, we’d calculate that they would cover around 37-63% of the potential demand for permits in the EU scheme.

Whilst a somewhat vague range, it illustrates both the significance of CERs/ERUs and the concept that they probably won’t be enough to cover demand for permits.

In turn this means that the CO₂ price should trade at a premium to the CER/ERU cost of <€10/t. How much more is largely function of the level of abatement that needs to be delivered, as discussed in the next chapter.

Table 14: UN permits available to cover the EU scheme demand

Mt CO ₂ equiv	EU targets -10% NAP2 vs NAP1	EU repeats average adjustment factor done so far = -13% NAP2 vs NAP1
EU permit demand	155	219
UN permits available	200	200
Proportion going outside EU	51%	60%
UN permits coming to EU	98	80
UN permits % demand	63%	37%

Source: JPMorgan estimates.

What's the UN's position post Kyoto?

In mid November 2006 the United Nations Framework Conference on Climate Change (UNFCCC) held its annual policy meeting, this year in Nairobi.

The decisions made at this meeting mostly related to technical matters, and rather than reaching a post-2012 agreement it simply reached agreements on "*a detailed work plan spelling out the steps needed to reach agreement on a new set of commitments*".

The main statistic referred to the UNFCCC is that "*global emissions of greenhouse gases have to be reduced to very low levels, well below half of levels in 2000, in order to avoid dangerous climate change*".

Clearly reaching a set of final commitments similar to those reached in the Kyoto Protocol is likely to be a very protracted process. We would expect, though, that it is substantially more ambitious than the 5%-over-20-years reduction of Kyoto in terms of both scale and timing.

The next UNFCCC technical negotiations are to be held in Bonn on May 7-18, 2007, but we would not expect any major news at that stage. Then in December 3-14, 2007 (probably to be hosted by Indonesia on the island of Bali) we see the potential for more substantive announcements to be made ahead of a formal review of the Kyoto process scheduled for a year later.

In reality, though, we wouldn't expect a new "global" agreement to be reached until after the next US Presidential elections, scheduled for November 2008.

The bottom line is that we remain convinced that there will be a "son of Kyoto", which will be both more substantial and long term than Kyoto itself, but that we are unlikely to get any final decision on magnitudes until 2009.

Carbon pricing

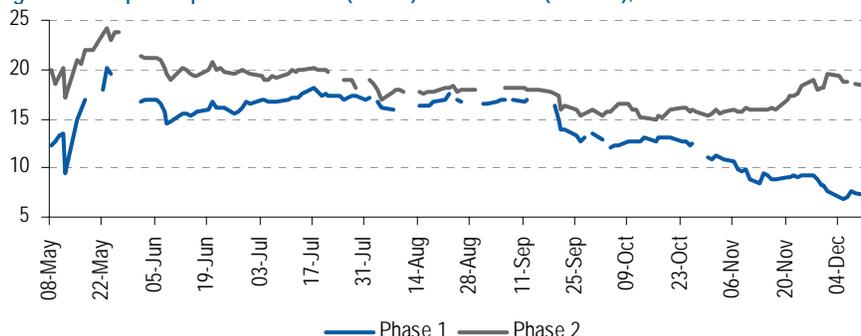
The CO₂ market is currently telling us that phase 1 is effectively a bust, and that phase 2 will be significantly stricter. Our core assumption is that phase 2 prices will settle at €20/t, but with significant uncertainty on the NAP2s in the EU this may become a fluid assumption in the coming months.

What does the carbon market tell us currently?

CO₂ permits have continued their roller-coaster ride since our last major update (see “*All you ever wanted to know about carbon trading vol 3*”, May 9, 2006). The main characteristics have been:

- **Mid to late May – Steady recovery from post-crash lows:** Phase 1 contracts reached lows of c€10/t and c€15/t on phase 2 following the announcement that too many permits were allocated for 2005. After this somewhat extreme sell-off, we believe the subsequent share price recovery was driven by: profit taking by short-sellers; a reappraisal of the potential for 2006/7 to not feature the same surplus of 2005; the potential for banking of permits from phase 1 to phase 2.
- **1st week in June – Another period of decline:** Expectations that the final Polish data might show a larger-than-expected surplus, combined with an abortive German proposal to sell up to 50mt of permits at a fixed price rather than auction pushed the price down by c20%, albeit on relatively narrow volumes.
- **Mid June to Mid September – A new stability:** With only a handful of phase 2 NAPs actually being presented by the EU’s theoretical June 30 deadline, the remainder emerging only slowly and relatively little natural trading from the utilities, the price of permits traded basically sideways for almost all of the third quarter in a range around €16-17/t for phase 1 and €18-20/t for phase 2.
- **Mid September to Early November – The weather strikes back:** In the period September 19 to October 14, phase 1 contracts came off by 28% to form a new level at c€12/t and phase 2 by 12% to c€15-16/t. We believe this was driven in large part by the realization that third quarter and early fourth quarter weather conditions were warmer and wetter than usual, reducing the demand for coal and gas fired power generating capacity. This drove a fall in all commodities (eg German power off by c5%, UK gas by c10%) including CO₂. This process took another leg down in late October.
- **Early November to Current – The EU gets tough:** In the run up to, and confirmation of, the EU’s pronouncements on phase 2 CO₂ NAPs we have seen a substantial widening of the contango between phase 1 and 2. To date, since November 9, we have seen a c20% fall in phase 1 and c20% rise in phase 2. The fall in phase 1 has been driven by the EU’s move to block banking, and a continuation of the “warm/wet weather trade”. We think the rise in phase 2 is clearly a consequence of the market anticipating a much tougher attitude by the EU than previously expected.

Figure 3: CO₂ permit prices - Phase 1 (2006/7) and Phase 2 (2008-12), €/t



Source: Bloomberg, JPMorgan estimates.

This market anticipation of a stricter EU attitude to phase 2 is confirmed, we believe, by the move in the spread between the phase 2 permit price and one of the more closely followed abatement costs – UK winter 2008 coal-to-gas abatement. This is now at the lowest level it has been at since the beginning of the year, although we would note it is still currently €20/t out of the money.

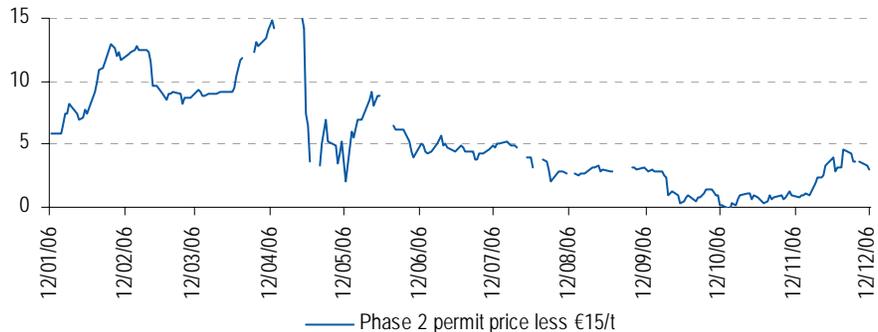
Figure 4: Comparison of UK winter abatement costs less permit prices for phase 2



Source: JPMorgan estimates, Company data.

Similarly, if we look at the phase 2 price compared to the potential price of CDM/JI permits (say around €15/t) we can see that the spread between the phase 2 price and the potential CDM price has returned close to its 1 year average (€5.3/t) having been near zero for most of 3Q/early 4Q. This would suggest to us that the carbon market is at least pricing in a full complement of CDM/JI permits, and that industrial abatement (but not yet power) is required.

Figure 5: Phase 2 permit price less €15/t as a proxy for need for CDM/industrial abatement



Source: JPMorgan estimates.

We therefore believe the CO₂ market clearly shows us (a) that phase 1 is more-or-less a “bust” as a result of the very warm ‘06/07 winter and the final blocking of banking into phase 2 and that (b) the EU will be significantly more strict in phase 2 than in phase 1 and that abatement beyond CDM/JI credits will be needed.

Where could CO₂ prices go?

So far we have identified around 155-219mt of potential demand for permits each year in phase 2. To cover this demand we’d identify:

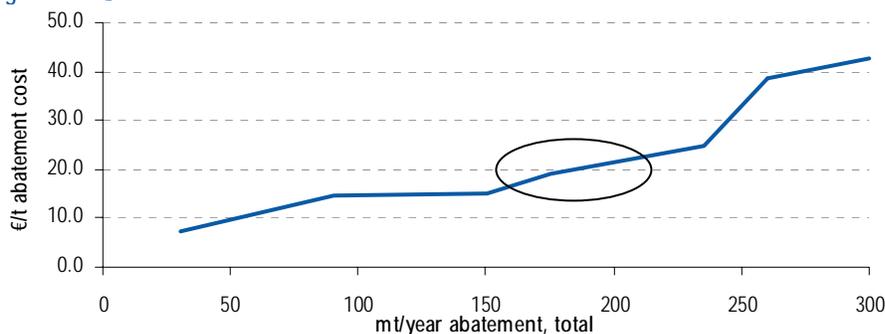
- **CDM/JI:** We see around 80-100mt per year coming in from the UN flexmex schemes (ie a high uptake from the non-EU schemes). Our Structured Commodity & Environmental Products team currently see CERs trading at around €14.3-14.8/t for 2008-09 delivery (contact nigel.r.scott@JPMorgan.com for more information). Press reports put ERUs at around half this level currently.
- **Industrial abatement:** We would not try to replicate the industrial abatement models that the specialist consultancies do (eg PointCarbon, New Carbon Finance), but if one-third to half of the potential industrial abatement they indicate comes through we’d see around 60mt pricing in at c€15/t and a similar quantity at €25/t.
- **Electricity abatement:** As indicated in Appendix 3 of this note, we calculate UK power generation switching from coal-to-gas costing around €19/t currently in summer and €38/t in winter. We’d also identify German lignite-to-coal switching at slightly over €40/t. In our recent report “*The Junction Box v2*” (October 12, 2006) we also calculated that coal with carbon-capture & sequestration (CCS) would breakeven at €35/t at our long-term commodity price assumptions (ARA#2 at \$40/t, oil and \$50/bbl).

As indicated in the chart below, all this suggests that the market should clear at around c€20/t in the middle of our identified demand range of 155-219mt/year for phase 2.

We'd make two further points:

- **Significant uncertainty remains:** As mentioned throughout the note so far we still have significant uncertainties with regards to (a) what the EU does with the remaining NAPs, (b) the inflow of UN flexmex credits is still hard to discern, and (c) phase 1 is illustrating that exogenous factors (such as weather conditions) can have a significant impact on near-end pricing.
- **Price inelasticity despite wide spread of possible demand levels:** Demand of 155-219mt (a near 50% spread) can be met between €15-22/t, suggesting that without any major changes in EU climate policy towards the NAPs that the overall decision making process is unlikely to make a significant difference to CO₂ prices. We would need to see demand materially below or above these levels to see the CO₂ price outcome being significantly different to our €20/t central case.

Figure 6: CO₂ abatement "merit order"



Source: JPMorgan estimates.

That's great, but what's the bottom line?

Phase 1 is effectively a write-off, we believe, but is of little consequence given that the biggest "shorts" (the power generators) should already have mostly fully contracted for 2007 already.

Looking into phase 2, the recent movement in CO₂ prices seems to support the idea that the EU's tightening, combined with the emergence of other trading schemes over the next five years means we are more likely to be a "€20/t world" than a "€10/t world". We believe a paradigm shift in EU opinion towards the NAPs is needed to move outside of the 155-219mt/year demand level we forecast before prices would move materially away from this €20/t level.

We therefore continue to use €20/t CO₂ assumptions in our financial forecasts for the utilities in Europe.

Please see the accompanying report "*Everything you need to know about carbon trading vol 4 pt 2: Equity trades on CO₂: We like it clean*" for more details.

Going forward, though, we will need to continue to review these assumptions, and perhaps be able to tighten them up somewhat as we get more information on phase 2 NAPs from the EU, and further clarity on the development of schemes elsewhere in the world.

Appendix 1 – Recap on abatement cost calculations

In line with the economic laws of supply and demand, a market will clear when the price is set at a level where supply equals demand. In the CO₂ market, supply is generated through government action – ie the allocation of permits. Demand is managed by the emitters.

In the CO₂ space, we see the main method of reducing demand for permits in volume is via switching from a highly CO₂-intensive production technology to a lower CO₂-intensity technology. Of the 5 CO₂ ETS sectors, we see the utility sector as having the biggest opportunity for doing this – it accounts for c60% of the scheme, and power can be produced from different technologies.

The main cited abatement potential is from coal-fired power production in the UK to gas-fired power production. We'd also see switching in Germany from lignite-fired production to hard coal-fired production as a potential area.

UK coal-to-gas switching

We have used API#2 ARA coal contracts plus a domestic freight cost of \$4/t, and a run rate of 0.4t/MWh (equivalent to 36% thermal efficiency) compared to Bloomberg's baseload UK power contracts to generate a "dirty dark spread".

For the "dirty spark spread" we have used NBP gas prices at a heat rate of 5,900btu/kWh (58% efficiency achieved by Siemens Frame H and Alstom GT26).

We have then deducted the spark spread from the dark spread and divided by the CO₂ emission reduction of 530kg/MWh to arrive at an abatement cost in €/t.

More importantly, we have built separate functions for summer and winter switching. We see summer switching as being more relevant as almost all capacity is required to run during the winter months due to the level of demand on the system.

German lignite to coal switching

As per the UK we have used API#2 coal contracts, this time compared to EEX baseload German power contracts for the dirty dark spread, using 0.33t/MWh (43% efficiency, higher than the UK and reflecting newer coal plant technology).

Lignite is not a market traded commodity, so we have used our own assessment of the "dirty lignite dark spread", which remains flat over time, reflecting the mouth-of-mine nature of lignite power plants.

Other abatement approaches are available, but difficult to track

We would note that there are obviously other ways to abate CO₂: CER certificates under JI / CDM methods; reduction in output by industrial (rather than utility) emitters; longer term building of new generation plant (eg nuclear). However, the economics of these methods are not readily calculated – they are generally based on proprietary technologies or embedded industrial margins – and as such we would not expect them to be direct drivers of the CO₂ price on a day-to-day basis.

The table below takes a snapshot of CO₂ prices and abatement costs as at December 8, 2006. We have built a suite of Bloomberg CIX functions to track these abatement costs, which are available to JPM clients on request. Regular updates of these statistics can be found in our weekly review “The Equity Meter Reader”, again available to JPM clients on request as part of our Utilities research product offering.

Table 15: CO₂ prices vs utility abatement costs

	€ / tonne					% change since				% vs relevant permit				
	Last quote	-1w	-1m	-2m	-3m	-1w	-1m	-2m	-3m	Last quote	-1w	-1m	-2m	-3m
Permit price, 2007	7.65	8.80	9.85	12.75	16.95	-13.1%	-22.3%	-40.0%	-54.9%					
Permit price, 2008	18.60	18.10	16.00	16.00	18.05	2.8%	16.3%	16.3%	3.0%					
Permit price, 2009	18.55	18.10	16.75	16.20	18.50	2.5%	10.7%	14.5%	0.3%					
Abatement costs														
UK summer 2007	11.85	14.52	20.66	21.95	30.37	-18.4%	-42.6%	-46.0%	-61.0%	55%	65%	110%	72%	79%
UK summer 2008	17.14	18.51	20.83	21.30	27.12	-7.4%	-17.7%	-19.5%	-36.8%	-8%	2%	30%	33%	50%
Germany, 2007	42.04	43.75	43.94	45.10	43.13	-3.9%	-4.3%	-6.8%	-2.5%	450%	397%	346%	254%	154%
Germany, 2008	42.87	44.37	45.44	47.16	45.68	-3.4%	-5.6%	-9.1%	-6.2%	130%	145%	184%	195%	153%
UK winter 2007/08	42.59	42.72	46.17	52.90	60.45	-0.3%	-7.7%	-19.5%	-29.5%	129%	136%	189%	231%	235%
UK winter 2008/09	38.68	38.68	36.73	41.96	45.79	0.0%	5.3%	-7.8%	-15.5%	108%	114%	119%	159%	147%

Source: Bloomberg, JPMorgan estimates.

Appendix 2 – Experience from 2005

Too many permits were allocated. In effect 97mt of permits were allocated above those that were actually required, suggesting either (a) poor calculation methodologies up front and / or (b) gaming by governments in their allocations. It's notable that the only shortfall countries were Austria, Ireland, Italy and Spain (which saw weak hydro conditions) and the UK (which is arguably the only EU country seriously trying to deliver its climate change targets).

Table 16: 2005 permit allocations vs actual emissions

Country	Issued	Verified emissions	Surplus	% surplus
Total as reported	1,999,805	1,902,730	97,075	4.9%
Poland	151,048	121,542	29,506	19.5%
Germany	494,979	469,468	25,511	5.2%
France	150,366	131,238	19,128	12.7%
Czech Republic	96,911	81,119	15,791	16.3%
Finland	44,614	33,052	11,562	25.9%
Denmark	37,304	26,469	10,835	29.0%
Lithuania	13,503	6,604	6,900	51.1%
Netherlands	86,452	80,351	6,101	7.1%
Slovakia	30,471	25,232	5,239	17.2%
Hungary	30,236	25,853	4,383	14.5%
Estonia	16,742	12,622	4,121	24.6%
Belgium	58,311	55,314	2,997	5.1%
Sweden	22,278	19,311	2,967	13.3%
Latvia	4,070	2,853	1,218	29.9%
Portugal	36,896	36,413	483	1.3%
Slovenia	9,138	8,704	434	4.8%
Greece	71,135	71,067	68	0.1%
Austria	32,413	33,373	-960	-3.0%
Ireland	19,237	22,367	-3,130	-16.3%
Italy	215,739	221,395	-5,656	-2.6%
Spain	171,938	181,063	-9,125	-5.3%
UK	206,023	237,320	-31,297	-15.2%

Source: EU Environment Commission, JPMorgan estimates

Appendix 3 – A potted guide to CO₂ trading

How did CO₂ credits come into existence?

Table 17: Kyoto targets

EU-15	-8%
Most other European countries	-8%
US	-7%
Canada	-6%
Hungary	-6%
Japan	-6%
Poland	-6%
New Zealand	0%
Russia	0%
Ukraine	0%
Norway	+1%
Australia	+8%
Iceland	+10%

Source: UNFCCC. Targets are for all Greenhouse Gas emissions by 2008 – 2012 vs 1990 levels.

Since 1992, the international community has been working on the issue of climate change through the United National Framework Convention on Climate Change (UNFCCC). The UNFCCC is a response to the observed rise in global temperatures over the last hundred years, which is (likely) caused by emissions of greenhouse gasses (GHGs), primarily CO₂.

The Kyoto Protocol was then signed in 1997. It is a binding commitment for 41 industrialized countries (known as Annex 1 countries) to reduce their GHG emissions to 5% below the 1990 level by 2010, with separate targets for each country. Developing countries outside this Annex 1 group were not assigned specific targets given low current per-capita emissions and limited financial resources to tackle the problem. However, signatories will monitor their emissions and can also participate in clean development mechanism projects (see below).

The protocol has now been converted into national law for all the countries that have ratified the treaty. Australia and the United States have failed to ratify the treaty and are not bound by the limits shown in Table 8. The US absence throws some doubts on the efficacy of Kyoto – the US emits 25% of all global GHGs – but Kyoto is a binding commitment for the signatories in any case.

Recognizing that there will be considerable costs in making these reductions, and that the market is a more efficient than government edict as a mechanism to achieve them, Kyoto provides for the possibility of emission trading.

What is the EU Emission Trading Scheme?

The EU signed up to Kyoto as a bloc with a target of an 8% reduction in emissions. The reservoir of emissions was then divided up through a mechanism known as burden-sharing. In addition, the EU has established the Emission Trading Scheme (EU-ETS). The EU-ETS covers only emissions of CO₂ (not other gases) from **large, stationary** installations (ie not from transport or small installations).

Across the EU, some 11,500 installations are involved in the scheme, together accounting for 30% of total GHG emissions (45% of CO₂ emissions). The first period of the ETS runs from 2005-07 to establish the system and provide early reductions in emissions. There will be a second period from 2008-12.

In December 2005 the EU Commission confirmed its commitment to meeting its Kyoto targets, and requires all EU countries to set their allocations for 2008-12 to be consistent with this aim. More specifically, allocations for 2008-12 cannot be above those for 2005-07.

Further data on the EU's requirements and projections can be found at the European Environment Agency's website at:

http://reports.eea.eu.int/eea_report_2005_8/en

How does CO₂ trading work in practice?

The ETS is a "cap and trade" system – national governments/the EU sets the total number of CO₂ certificates that will be created and allocates them to installations.

Hence each installation has an "account" in the registry into which a certain quantity of permits is allocated for free at the start of the period. Over the course of the year, the installation is required to monitor its CO₂ emissions and at the end of the year it must have sufficient permits in its account to cover its emissions (although 2005, 2006 and 2007 permits are fungible an installation can "borrow" from future years within phase 1 to make up earlier year shortfalls or "bank" permits for later use).

An individual installation can operate up to the level of its "free" permits; operate more and buy permits, or operate less and sell permits. If it is technologically possible, it can also take action to abate the amount of CO₂ emitted at the same level of production. If, however, the installation fails to deliver the required number of permits, it is fined €40/t (rising to €100/t in phase 2) plus it has to deliver permits the following year. What happens, however, if there are physically no permits left in 2007, is unclear – on our reading there is no scope in the directive for 2008 permits to be substituted.

This scheme has the effect of spreading the cost of abatement across all CO₂ emitting installations while allowing the actual abatement to be done by the installations that have the lowest cost, as shown below (in the EU's example).

How does the JI/CDM fit into all this?

Those Annex 1 countries that have ratified Kyoto must achieve reductions in GHG emissions primarily through domestic measures. However, it is also possible for an Annex 1 country to implement a Joint Initiative (JI) project in another Annex 1 country and count any reduction in emissions towards its own target.

In addition, it is possible for an Annex 1 country to implement Clean Development Mechanism (CDM) projects in developing countries and receive certified emission reduction certificates (CERs) which count towards the Annex 1 countries reductions.

To encourage companies to engage in emission reduction, the ETS allows for a company implementing a project that gains CERs to exchange these for ETS credits, which can then be sold. The first ever CERs were issued in October 2005 in relation to hydroelectric projects, and there are many more projects in the pipeline. Many of these projects relate to non- CO₂ greenhouse gases, which are converted into CO₂ tonnage equivalent (see table to right).

Table 18: CO₂ equivalent of other GHGs

Carbon Dioxide	1
Methane	21
Nitrous Oxide	310
HFCs	140-11,700
PFCs	6,500-7,500
Sulfur Hexafluoride	23,900

Source: IEA

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The tables below outline our views on how the EU arrived at its decisions on the 9 NAPs reported on November 29, 2006, and our projection for the announcements yet to be made assuming this pattern is continued.

Table 19: How were the NAP2 decisions calculated?

CO ₂ , kt equiv	2005			2010 Basic allowance	EU adjustments	EU allowed NAP	Requested adjustment	Requested NAP
	emissions	% growth	% efficiency					
Germany	474,000	9.6%	-13.1%	457,410	-0.9%	453,100	1.7%	465,000
Greece	71,300	19.9%	-13.1%	76,148	-9.3%	69,100	-0.9%	75,500
Ireland	22,400	27.2%	-13.1%	25,558	-17.2%	21,150	-11.4%	22,640
Latvia	2,900	50.0%	-13.1%	3,970	-16.9%	3,300	93.9%	7,700
Lithuania	6,600	37.4%	-13.1%	8,204	7.3%	8,800	102.3%	16,600
Luxembourg	2,600	27.2%	-13.1%	2,967	-9.0%	2,700	33.1%	3,950
Malta	1,980	11.9%	-13.1%	1,956	7.3%	2,100	51.1%	2,956
Slovak Republic	25,200	32.4%	-13.1%	30,064	2.8%	30,900	37.4%	41,300
Sweden	19,300	16.6%	-13.1%	19,976	14.1%	22,800	26.2%	25,200
UK	242,400	14.3%	-13.1%	245,309	0.4%	246,200	0.4%	246,200
Total	868,680	13.4%	-13.1%	871,561	-1.3%	860,150	4.1%	907,046

Source: JPMorgan estimates. European Commission report from 29 November 2006

Table 20: Potential NAP2 under EU guidelines assuming average -1.3% adjustment factor

	2005			2010 Basic allowance	EU adjustments	EU allowed NAP	% ch vs phase 1	% vs Requested phase 2
	emissions	% growth	% efficiency					
Belgium	55,314	11.5%	-13.1%	54,426	-1.3%	53,719	-13.4%	-14.9%
France	131,238	11.0%	-13.1%	128,417	-1.3%	126,747	-19.0%	-15.3%
Cyprus	6,671	21.1%	-13.1%	7,203	-1.3%	7,110	24.6%	10.2%
Estonia	12,622	49.7%	-13.1%	17,238	-1.3%	17,014	-10.2%	-30.8%
Finland	33,052	13.7%	-13.1%	33,248	-1.3%	32,816	-27.9%	-17.1%
Netherlands	80,351	13.7%	-13.1%	80,828	-1.3%	79,778	-10.3%	-13.8%
Poland	121,542	26.4%	-13.1%	137,728	-1.3%	135,938	-42.9%	-47.0%
Slovenia	8,704	24.6%	-13.1%	9,706	-1.3%	9,580	9.4%	15.4%
Austria	33,373	11.0%	-13.1%	32,655	-1.3%	32,231	-3.2%	-1.7%
Czech Republic	81,119	25.8%	-13.1%	91,434	-1.3%	90,245	-7.5%	-11.4%
Denmark **	26,469	11.5%	-13.1%	26,044	-1.3%	25,705	-23.1%	-23.1%
Spain	181,063	17.6%	-13.1%	189,257	-1.3%	186,797	2.6%	22.4%
Hungary	25,853	14.2%	-13.1%	26,150	-1.3%	25,810	-13.8%	-16.3%
Italy	221,395	7.2%	-13.1%	208,330	-1.3%	205,622	-7.4%	-1.6%
Portugal	36,413	8.8%	-13.1%	34,845	-1.3%	34,392	-9.9%	1.3%
Total	1,055,179	15.2%	-13.1%	1,077,511	-1.3%	1,063,504	-15.7%	-13.9%
Total including decisions made	1,923,859	14.4%	-13.1%	1,949,073	-1.3%	1,923,735	-12.9%	-10.2%

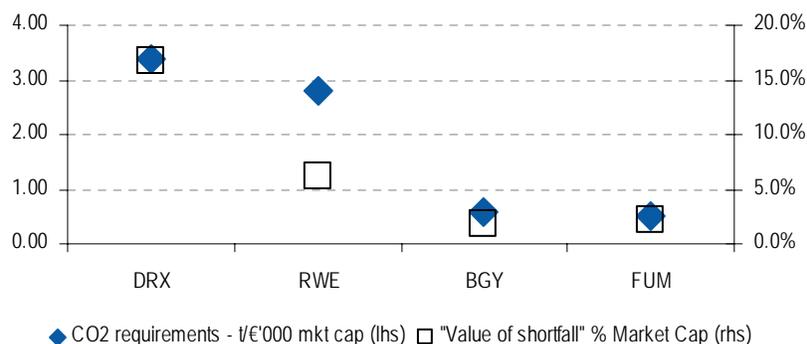
Source: JPMorgan estimates. ** Note that Denmark has not proposed a NAP yet, nor have we seen any press reports.

All you ever wanted to know about carbon trading, vol 4 pt 2

Equity trades on CO₂ - We like it clean

- **The EU cracks the whip:** On November 29 the EU tightened the requested NAPs (National Allocation Plans) of 9 countries by an average 5%. If repeated across the other countries we calculate this will generate a demand for permits of 155-219mt. On the basis of this range, we see the CO₂ price settling at around €20/t long term.
- **The utilities feel the pain:** We believe 100% of the cost of CO₂ permits is already priced into power and hence revenues of the utilities. The utilities currently benefit from the “double windfall” of higher power prices and free CO₂ permits. However, we believe any cut to the allocation of permits will fall on the utilities, and hence their profitability and valuation.
- **Be clean, not dirty:** As a consequence, we would prefer to orient portfolios towards “clean” generators that operate in floating price environments, such as Fortum and British Energy, and away from “dirty” generators, such as RWE and Drax.
- For further details regarding the CO₂ market, please see the accompanying report “All you ever wanted to know about carbon trading, vol 4 pt 1: Until you know everything, you know nothing”.

Figure 2: Exposure to CO₂ permits vs cost from a shortfall of permits allocated



Source: JPMorgan estimates.

Electric Utilities, Independent Power Producers

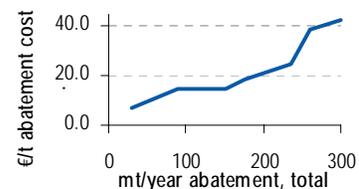
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Figure 1: CO₂ abatement cost "merit order"



Source: JPMorgan estimates.

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Investment thesis

The CO₂ situation is tightening for the European utilities – enough to raise costs, but not enough to raise prices. We'd buy the "clean" generators in liberalised markets (Fortum, British Energy) and sell the "dirty" generators (Drax, RWE).

The CO₂ situation is tightening...

In the accompanying report "All you ever wanted to know about carbon trading, vol 4 pt 1" we detail our views on the CO₂ market currently.

On November 29 the EU made initial announcements on 2008-12 allocations for 9 countries representing 45% of the ETS (Emission Trading Scheme). They cut allowances relative to requested NAPs by 5%, and tightened up a number of specific issues on: access to UN flexmex permits; ex-post adjustment potential; Germany's "4+14" rule.

If this move is repeated for the rest of the NAPs (and we won't know for sure until mid next year we believe) then we calculate the "demand" for permits could run at around 155-219mt/year.

Aside from a harsher attitude from the EU, we also see competition for permits coming from potential trading schemes from outside of the EU. We are steadily seeing the emergence of trading schemes in the US (RGGI and California) and Australia, and significant government purchases by Japan. In total we estimate these could absorb 50-60% of UN flexmex (ie CDM/JI) permits, pushing up EU permit prices potentially.

Despite this, though, our assessment of the "abatement merit order" leads us to maintain our €20/t phase 2 CO₂ permit assumption.

...enough to raises costs, but not enough to raise prices

Given the tightening of allowances we believe the utilities face potentially significant extra costs from CO₂ permits during phase 2. We'd value the overall "cost" of CO₂ permit shortfalls at between 1.6% and 23% of market cap, with an average amongst the generators we cover of 4.8%.

Given our assessment of the CO₂ abatement merit order and the experience of recent power price moves we believe that a significantly larger shortfall than what we currently expect is needed to push CO₂ prices and power prices higher. Without this boost the cost of extra permits will be offset directly against profits and value.

Buy the "clean" generators, sell the "dirty" generators

Given the uncertainty on carbon permits, but the tendency towards ongoing tightening, we believe investors would be better positioned in low-CO₂ intensity generators in liberalized price environments. These avoid the risks of higher costs whilst still having upside optionality should CO₂ and power prices begin to rise once more. We would therefore overweight Fortum and Drax in a utilities portfolio relative to British Energy and RWE.

Fortum (OW, Target Price €24.3)

Fortum has the fourth lowest CO₂ intensity in the group as a result of its high exposure to hydro and nuclear. The Finnish NAP should only need marginal adjustment, and the Swedish NAP has already been announced.

The Nordic market is fully liberalized, and we believe there is upside in convergence with Central European prices as well as optionality on CO₂ pricing. For more information please see our report "*Head North for Growth*", August 31, 2006.

British Energy (OW, Target Price 560p)

British Energy's ownership of Eggborough means it is not entirely "clean", but it is in the bottom quintile by carbon intensity despite the harsh UK NAP. The UK liberalized market should give upside optionality assuming output can be returned to normalized levels.

The stock looks undervalued to us, and should be a beneficiary from any new UK-specific CO₂ policies relative to the other generators. For more information, please see our report "*Upgrade to overweight - worth a crack*", November 22, 2006.

Drax (N, Target Price 845p)

As a mono-line coal power plant, Drax has the second highest carbon exposure in the group. The UK NAP has already been approved, limiting fundamental downside risk, but we'd still see the stock trading as a "carbon proxy".

We'd also see further downside should the UK follow a more unilateralist approach to environment policy. The stock valuation looks fairly valued currently, but we would trade it against British Energy. For more information, please see our report "*Still Nifty at Fifty*", September 20, 2006.

RWE (N, Target Price €1.7)

RWE is the biggest polluter in Europe in absolute terms and is the third most CO₂ exposed utility we cover. It operates in arguably the two toughest CO₂ markets – the UK and Germany. Given ongoing competition authority pressure on pricing, we see clear downside risk to profits from incremental negative CO₂ news.

Aside from significant negative news on commodities though, we'd expect the market's willingness to suspend its disbelief regarding M&A as being supportive for the shares. We would trade it against Fortum though as a CO₂ play. For more information, please see our report "*Moving to \$50/bbl oil in North Europe*", August 31, 2006.

A summary of our CO₂ views

In the accompanying report "All you ever wanted to know about carbon trading, vol 4 pt 1" we detail our view that the EU's recent moves suggest a significant tightening of stance towards phase 2 allocations vs phase 1 than we might have expected in the past.

Given the EU's moves so far, we find demand for permits could be 155-219mt/year in phase 2. We also find that given potential demand for UN flexmex permits from outside the EU, the CO₂ price should stay in the range of €20/t for phase 2.

Potential EU demand for permits

On November 29, 2006, the EU made initial announcements on the 2008-12 CO₂ national allocation plans of 9 states, accounting for c45% of the overall scheme. On average, the EU cut the requested allowances by 5%, giving an average cut vs 2005-07 of 9.2%. The EU also amended a number of country-specific items including access of UN flexmex permits, ex-post adjustments and Germany's infamous "4+14 rule".

Given the reaction of the CO₂ price, we believe this is significantly tougher than the market initially expected.

We believe that average "cuts vs requests" are going to run at around 9-14% for the remaining countries that the EU will report on, generating a shortfall vs requests of 155-219mt in aggregate per year.

The burning question, of course, is what the actual demand for permits might be. Given that 2005 was over-allocated to the tune of 94mt this might suggest the 155-219mt shortfall vs requests is the maximum "demand" level also if governments have repeated their apparent "gaming". However, we would wait until seeing 2006 data and final NAP2 approvals for all countries before being too definitive in this regard.

Demand for permits outside the EU

We believe that we will, eventually, see the emergence of a global (or at least multi-regional) GHG cap-and-trade scheme. However, this is clearly a post-2012 proposition.

In the meantime, given Japan can take c10mt per year from next year at €10/t, RGGI could take 22mt of emissions at a price well below the current EU ETS post 2009, California as much as 70mt from 2011 before counting potential from other US states, Australia or China, we'd see at least 50% of UN permits going to other schemes.

Assuming that 50-60% of UN permits go to other schemes for 2008-12, we'd calculate that they would cover around 37-63% of the potential demand for permits in the EU scheme.

Whilst this is a somewhat vague range, it illustrates both the significance of CERs/ERUs and the concept that they probably won't be enough to cover demand for permits.

Figure 3: 2008 CO₂ permit prices, €/t since end October 2006



Source: Bloomberg

In turn this means that the CO₂ price should trade at a premium to the CER/ERU cost of <€10/t. How much more is largely function of the level of abatement that needs to be delivered, as discussed in the next chapter.

Table 1: UN permits available to cover the EU scheme demand

Mt CO ₂ equiv	EU targets -10% NAP2 vs NAP1	EU repeats average adjustment factor done so far = -13% NAP2 vs NAP1
EU permit demand	155	219
UN permits available	200	200
Proportion going outside EU	51%	60%
UN permits coming to EU	98	80
UN permits % demand	63%	37%

Source: JPMorgan estimates.

Potential permit price

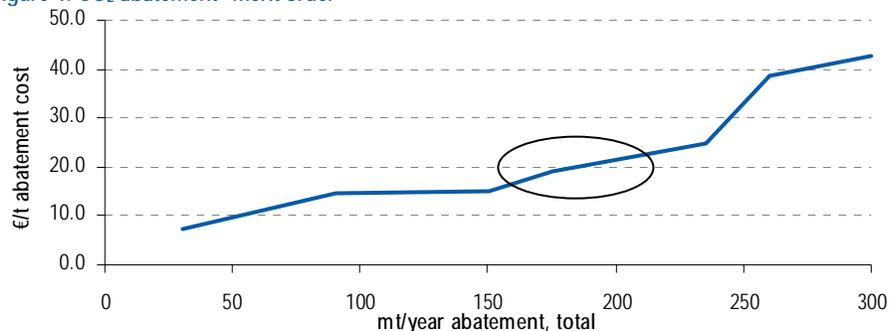
Phase 1 is effectively a write-off, we believe, but is of little consequence given that the biggest “shorts” (the power generators) should already have mostly fully contracted for 2007 already.

Looking into phase 2, the recent movement in CO₂ prices seems to support the idea that the EU’s tightening, combined with the emergence of other trading schemes over the next five years means we are more likely to be a “€20/t world” than a “€10/t world”. We believe a paradigm shift in EU opinion towards the NAPs is needed to move outside of the 155-219mt/year demand level we forecast before prices would move materially away from this €20/t level.

We therefore continue to use €20/t CO₂ assumptions in our financial forecasts for the utilities in Europe.

Going forward, though, we will need to continue to review these assumptions, and perhaps be able to tighten them up somewhat as we get more information on phase 2 NAPs from the EU, and further clarity on the development of schemes elsewhere in the world.

Figure 4: CO₂ abatement "merit order"



Source: JPMorgan estimates.

Get the balance right – key CO₂ plays

Taking a blend of carbon intensity (CO₂ requirements vs market cap) and exposure to shortfalls in allocations (extra costs times consensus P/E vs market cap) suggests we should avoid "dirty" generators including Drax and RWE, and invest in "clean" generators in variable price markets, such as Fortum and British Energy.

Who's exposed?

Basically all the generators (including the perceived "super-clean" generators like British Energy and EDF) have a CO₂ permit requirement. The table below summarises our views on:

- Our forecast of permits required for "business as usual" in 2008-12
- The allocations we expect for 2008-012, in light of the recent EU decisions
- The percentage shortfall of allocations vs requirements
- The shortfall we expect in millions of tonnes per year
- The value of the shortfall, calculated as the cost of shortfall per year at €20/t, multiplied by the stock's consensus P/E rating for 2008 as a percent of market capitalization.

Table 2: Exposure of European Utilities to CO₂ permit shortfalls

mt/year	Required, 2008 - 12	Allocated, 2008E - 12E	Allocation vs Required	Shortfall	"Value" of shortfall % Market Cap
United Kingdom					
Centrica	6.6	4.8	-28%	1.8	1.6%
Drax	19.4	9.6	-50%	9.8	16.8%
Brit Energy	6.7	4.8	-29%	1.9	1.9%
SSE	24.6	16.2	-34%	8.5	8.0%
ScottishPower	15.1	10.0	-33%	5.0	6.1%
International Power	11.7	5.0	-57%	6.7	14.5%
North Europe					
E.ON	80.4	67.6	-16%	12.9	3.6%
RWE	138.8	122.8	-12%	16.0	6.2%
EDF	53.6	45.4	-15%	8.2	2.1%
Fortum	9.8	7.4	-24%	2.4	2.2%
Suez	50	45	-10%	5.0	2.2%
South Europe					
Endesa	35.4	19.8	-44%	15.6	10.0%
Iberdrola	12.4	6.9	-44%	5.5	3.8%
Union Fenosa	17.2	9.6	-44%	7.6	11.9%
Gas Natural	6.8	3.8	-44%	3.0	5.1%
Enel	54.2	44.2	-18%	10.0	4.1%
EDP	13.2	8.3	-37%	4.9	6.2%
PPC	52.3	52	-1%	0.3	2.1%

Source: JPMorgan estimates.

Offset for fewer permits?

The impact of CO₂ is expressed in utility profits as a balance between the cost of buying extra permits and the revenue gained from higher power prices.

Extra costs ...

Clearly, fewer permits equate to higher costs for the utilities. Assuming the aggregate reduction from the EU of c5% vs requested NAPs is continued across the whole of the EU, this would cut allocations vs requests by 155-219mt. At our core €20/t assumption this is equivalent to €3.1-4.2bn/year of extra costs.

Given that the stocks we cover equate to around 43% of the power sector by emissions, and given that we expect almost all the shortfall to be passed onto the utilities, we could see these costs being equivalent to an incremental 2.5-3.5% off annual profits.

... but not necessarily extra revenues

We estimate that 100% of the price of a permit is costed into traders' power price bids, despite them only having to buy (roughly) 10% of their required permits in phase 1 and around 20% in phase 2.

This generates a theoretical "permit" windfall of c€2.4bn (1.4bn t/a emissions, of which 12% bought using €20/t) for the generating utilities.

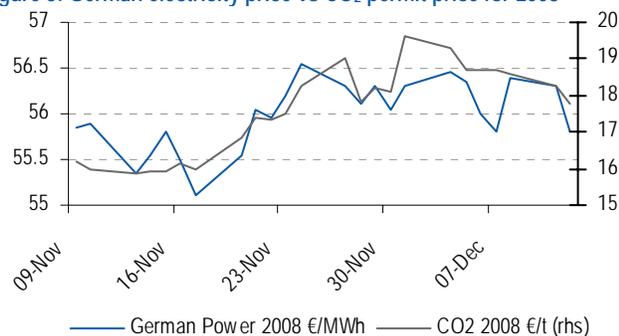
On top of this can be added the impact of higher prices on the non-thermal (ie nuclear and hydro) generation, which are price-takers in the market, which could be worth a further €5.6bn. This is based on 2005 nuclear & hydro output in UCTE, Nordel and UK, assuming a €20/t CO₂ price and based on coal-based price in UCTE/Nordel and gas-based in the UK.

Set in the context of this €50bn pa "benefit", the extra "cost" of €3.1-4.2bn per year looks trivial. However, the issue surely has to be one of earnings momentum – particularly with the sector trading at an all-time high FY2 (ie 2008) P/E ratio of c15x, on our estimates.

The projected shortfall range we expect should not (as shown in figure 2 above) lead to a material change in CO₂ prices. We therefore do not believe that the current EU moves are going to trigger another re-rating in power prices.

Indeed if anything since the announcements the "dirty" price (ie the power price less CO₂ permits) have come down. The charts below illustrate that whilst optically power and CO₂ have moved together, in reality the spread between the two has actually moved against the utilities.

Figure 5: German electricity price vs CO₂ permit price for 2008



Source: EEX, Bloomberg, JPMorgan estimates

Figure 6: "Dirty Price" = Power price less CO₂ price, 2008



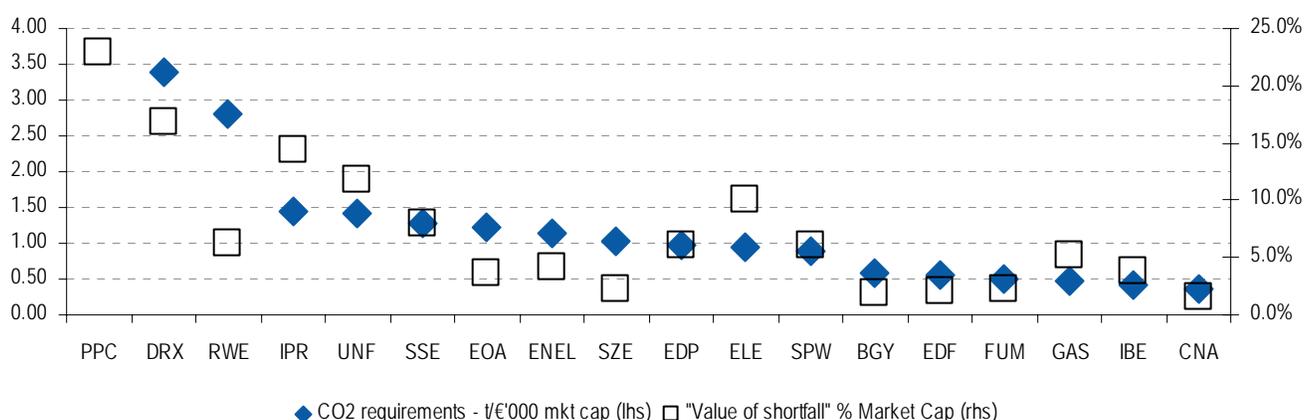
Source: JPMorgan estimates

How would we trade CO₂ exposures?

The chart below compares:

- The companies' CO₂ requirements per €000 market cap to capture the overall CO₂ exposure of the stock to (the solid diamonds in the chart);
- The "value of shortfall" as a measure of the negative impact resulting from the under-allocation of permits (the empty boxes in the chart).

Figure 7: Comparison of exposure to CO₂ permits vs cost from a shortfall of permits allocated



Source: JPMorgan estimates.

We'd therefore pick our key plays as being:

“Dirty” utilities to avoid

PPC, Drax and RWE have relatively high exposures to CO₂ per € of market cap, and face a relatively high cost associated with the shortfall in permit allocations they face.

We'd note that PPC has a high CO₂ intensity (off the scale at 11.4t/€000 market cap) and has a high level of potential costs from CO₂. However, the oil price remains the key fuel cost for the company.

“Clean” utilities to go for

Amongst the generators we'd see both Fortum and British Energy as being good plays as they have a relatively low CO₂ intensity (British Energy's only comes from Eggborough) and the costs they face from permit shortfalls are a relatively small part of their market capitalization. Additionally, both operate in floating price markets, so should the CO₂ price start to drive power prices higher they should see “upside optionality”.

EDF and the Spanish utilities operate in regulated or pseudo-regulated environments and therefore don't have this upside potential. We wouldn't play Centrica as there is “downside optionality” if power prices start to rise.

That's great, but what's the bottom line?

The EU decisions have “cost” the utilities something in the order of €3.1-4.2bn per year in extra costs, but this has not been offset by higher prices. The EU has yet to complete its decisions on the 2008-12 NAPs. Until it has, and we believe that this process could take until well into next year, we think it makes sense to us to **retain our preference for "clean" generators such as Fortum and British Energy over the “dirty” ones such as Drax and RWE.**

Key CO₂ investment ideas

In light of our CO₂ views, on the positive side we like Fortum and British Energy, and would stay clear of RWE and Drax.

Fortum – OW, Target Price €24.3

For more information and financials on Fortum, please see “*Head North for Growth*”, August 31, 2006.

- **CO₂ positioning:** Fortum has the fourth lowest CO₂ intensity in the group under analysis as a result of the high proportion of nuclear and hydro output in its mix. We estimate its permit shortfall will only cost €47m/year, and the cost of this represents only around 2% of market capitalisation. Fortum retains, however, the upside optionality of higher power prices if CO₂ prices begin to rise.
- **Investment thesis:** In the short term we think Fortum remains a play on the weather. Long term, though, it should be able to generate significant earnings growth from the convergence of Nordic power prices with those of Central Europe. The company has a strong and proven strategy of reinvestment for growth and remains committed to returning value to shareholders.
- **Target price drivers and risks:** Our target price is based on a sum-of-parts using DCF with an average WACC of 6% and a 1% terminal growth rate. At our target price the stock would be trading only in line with the sector on P/E, but we believe the group’s relatively young assets, high growth rate, high returns and regearing potential justify perhaps a premium. Key risks stem from: further outages in the nuclear fleet; lower Nordpool power prices; taxation of nuclear / hydro profits in Sweden.

Table 3: Fortum - Valuation multiples at c-o-b December 12, 2006

Share price €22.44	2007E	2008E	2009E	2010E
P/E	14.1x	13.0x	12.9x	11.9x
EV/EBITDA	9.4x	8.9x	8.7x	7.9x
Dividend yield	3.3%	4.0%	4.5%	4.7%

Source: Bloomberg, JPMorgan estimates.

For more information and financials on British Energy, please see “*Upgrade to overweight – worth a crack*”, November 22, 2006.

British Energy – OW, Target Price 560p

- **CO₂ positioning:** Despite being mostly nuclear, British Energy’s ownership of Eggborough means it is only just in the bottom quintile by nuclear exposure. The UK permit shortfall exposure is relatively small at 2% of market cap. The UK market is a liberalized, and so BGY retains its upside optionality should CO₂ permits rise above our €20/t core scenario – assuming output can be returned to normalised levels.
- **Investment thesis:** Following the downward share price dislocation on output concerns we believe British Energy looks cheap both in absolute terms (16% upside to our Mar 08 target price) and relative to the other UK generators (particularly Drax). The possibility of a peer taking a strategic stake in the company, combined with the potential use of the company’s sites for new nuclear power plants suggests further upside is possible beyond our target price.
- **Target price drivers and risks:** We value British Energy using a DCF, using a 9% post-tax WACC and assuming 62TWh long-term output and a \$50/bbl oil long-term commodity forecast. Whilst we believe the stock should trade at a discount to the sector given its mono-line nature, the dividend yield of 10-12% per year that we forecast for the next three years makes for an attractive total return story. Key risks to our target price come from market electricity prices (and indirectly gas-oriented commodity prices) and plant outages.

Table 4: British Energy Valuation Multiples at c-o-b December 12, 2006

Share price 489p	2007E	2008E	2009E	2010E
P/E	10.5x	8.0x	6.9x	7.5x
EV/EBITDA	4.6x	4.0x	4.3x	5.6x
Dividend yield	8.0%	12.2%	11.2%	10.1%

Source: Bloomberg, JPMorgan estimates.

For more information and financials on RWE, please see “Moving to \$50/bbl oil in North Europe”, August 31 2006.

RWE – N, Target Price €71.7

- **CO₂ positioning:** RWE’s main operations are in arguably the two toughest CO₂ markets in Europe – Germany and the UK. We currently estimate RWE will be short of around 16.0mt/year in phase 2 – the highest amount in Europe – as well as being the third most CO₂ exposed utility we cover. When added to ongoing pressure from both the EU and the German competition authorities regarding market pricing we’d see most of the downside from lower emissions going straight to the bottom line.
- **Investment thesis:** RWE is currently trading at an 18% premium to our target price. We believe that the incrementalist approach to reinvestment is the right one to follow, but one that ultimately will be unlikely to generate further outperformance. Realistically, though, unless there is significant bad news regarding regulation of networks or competition policy, and in the context of the market’s ongoing willingness to suspend its disbelief regarding M&A we wouldn’t expect to see significant underperformance short term.
- **Target price drivers and risks:** Our target price is set using a sum of parts that is based on DCF. We use an average WACC of just under 6.0% and a terminal growth of c1%. The implied y/e 2007E EV/EBITDA is only 7.5x (a discount to the sector’s 9.2x) which we feel is deserved given (a) the relatively old asset base and (b) the low likelihood that the “regearing potential” will be unlocked. Key upside risks relate to the potential for new cost-cutting programmes and higher wholesale power prices. Key downside risks come from German network regulation and CO₂ allocations.

Table 5: RWE Valuation Multiples at c-o-b December 12 2006

Share price €87.95	2007E	2008E	2009E	2010E
P/E	15.7x	13.8x	13.2x	12.8x
EV/EBITDA	10.9x	8.0x	7.6x	7.3x
Dividend yield	5.2%	3.9%	4.1%	4.3%

Source: Bloomberg, JPMorgan estimates.

For more information and financials on Drax, please see “*Still Nifty at Fifty*”, September 20, 2006.

Drax – N, Target Price 845p

- **CO₂ positioning:** Drax has the second highest carbon exposure in the group, but the second highest exposure to the cost of permit shortfalls. This results from it being a “mono-line” coal-power generating plant, and largely is at the mercy of government policy on CO₂ and the commodity markets. On the upside, the EU has approved the UK’s “holier-than-thou” phase 2 NAP, so downside surprises are more likely to come from unilateral measures such as carbon taxes than elsewhere.
- **Investment thesis:** We find Drax’s valuation unexciting even under our long-term electricity price assumption of £41/MWh – our target price implies just 3% upside, although the 12% annual yield for the next three years may be attractive to short-term total return funds. However, Drax is likely to remain (rationally or not) the main UK “carbon play”, and we would be wary of ongoing government policy with regards to the environment in light of the Stern report.
- **Target price drivers and risks:** Our target price is set using a DCF, with an 8% post-tax WACC. We think the stock should trade at a discount to the sector given the fixed-life nature of the business, and it is worth noting that the yield will fall significantly if output falls in phase 2. Key upside risks come from commodity prices (cold weather and tight winter gas markets are key here), which drive the electricity price, and the potential for higher CO₂ prices.

Table 6: Drax Valuation Multiples

Share price 823p	2007E	2008E	2009E	2010E
P/E	6.2x	6.9x	6.5x	6.1x
EV/EBITDA	5.2x	6.7x	7.0x	7.0x
Dividend yield	15.7%	11.5%	13.4%	4.8%

Source: Bloomberg, JPMorgan estimates.

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Table 7: European Utilities Valuation Screen at c-o-b December 12, 2006

€bn / £bn	Rec.	Price	T.P.	% diff	Mkt Cap	EV	P/E		DPS Yield		EV/EBITDA	
							2007E	2008E	2007E	2008E	2007E	2008E
Sector - Pan-Europe				-8%	645.5	964.2	16.9x	14.9x	3.8%	4.1%	9.0x	8.2x
Sector - Europe ex UK				-8%	509.7	770.1	17.7x	15.5x	3.6%	3.8%	9.2x	8.3x
Sector - UK				-9%	135.8	194.1	13.8x	12.5x	4.8%	5.3%	8.3x	7.8x
Europe ex UK												
EDF	UW	54.80	41.20	-25%	102.1	156.8	23.7x	18.6x	2.2%	2.7%	10.0x	8.7x
EDP	OW	3.73	3.55	-5%	13.6	24.7	14.5x	12.3x	3.1%	3.3%	9.0x	8.0x
Enagas	N	20.08	18.80	-6%	4.8	6.5	21.0x	18.3x	2.5%	2.9%	11.8x	10.8x
Enel	OW	7.79	7.90	1%	48.0	63.2	14.7x	14.2x	6.9%	6.8%	7.4x	7.2x
Fortum	OW	22.83	24.30	6%	19.6	24.8	14.4x	13.3x	3.3%	3.9%	9.6x	9.0x
Gaz de France	*	33.62			33.1	39.0	14.6x	14.1x	3.3%	3.6%	7.4x	7.3x
PPC	UW	19.54	16.50	-16%	4.5	8.9	32.6x	22.5x	2.9%	4.5%	9.8x	8.7x
Red Electrica	OW	35.36	33.40	-6%	4.8	7.7	20.8x	19.1x	2.3%	2.6%	10.8x	10.2x
RWE	N	87.85	71.70	-18%	49.4	89.0	15.7x	13.7x	5.2%	3.9%	10.9x	8.0x
Suez	*	37.73			48.0	73.5	18.4x	15.3x	3.5%	4.0%	9.3x	8.3x
Union Fenosa	UW	39.26	35.50	-10%	12.0	19.4	14.9x	13.4x	2.3%	2.8%	8.9x	8.2x
Veolia	OW	51.70	56.00	8%	21.0	42.5	20.5x	17.7x	2.4%	2.8%	9.6x	8.8x
UK												
Brit Energy	OW	489	560	15%	11.7	11.0	10.5x	8.0x	8.0%	12.2%	4.5x	4.0x
Centrica	OW	334	335	0%	17.9	20.2	12.7x	11.1x	4.0%	4.4%	5.2x	5.1x
Drax	N	823	845	3%	4.9	5.6	6.2x	6.9x	15.7%	11.5%	5.2x	6.7x
Int Power	OW	379	355	-6%	8.3	16.5	14.1x	12.7x	2.6%	3.1%	9.1x	8.5x
Kelda	UW	910	715	-21%	4.8	7.8	17.5x	16.7x	3.6%	3.7%	8.6x	8.1x
National Grid	N	721	680	-6%	28.9	46.7	12.4x	12.0x	4.2%	4.6%	8.5x	8.1x
Pennon	UW	548	400	-27%	2.7	5.0	17.5x	15.8x	3.5%	3.7%	9.2x	8.7x
Severn Trent	N	1448	1200	-17%	7.5	12.3	18.8x	17.4x	3.9%	4.1%	8.3x	7.9x
Scot & South.	OW	1509	1310	-13%	19.2	22.6	14.7x	12.8x	4.0%	4.4%	9.5x	8.4x
United Utilities	N	784	635	-19%	10.1	16.9	13.3x	12.6x	5.9%	6.0%	8.4x	7.9x

Source: Bloomberg, JPMorgan estimates.

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Carbon trading - a quick recap

Carbon trading - key weapon to fight climate change

- EU commit to -8% 1990 - 2010 under Kyoto, with member state targets
- “Cap-and-trade” scheme implemented
- Each state allocates permits to emitters, which can be used or sold
- The Emissions Trading Scheme (ETS) Is the market for these permits
- The National Allocation Plans (NAPs) are set for 2005 - 2007 (phase 1) and 2008 - 2012 (phase 2)
- The NAPs for phase 2 are currently being assessed by the EU

What has the EU said recently?

Following mistakes in 2005-07, the EU is getting stricter

- EU assessing 2008 - 12 plans
- EU wants to correct 2005 - 07 over-allocation & meet Kyoto targets
- Proposed schemes from 10 countries cut by 5% in November
- Needless to say, the individual states have complained
- Airline industry into the trading scheme from 2011

What is the possible demand for CO2 permits?

Demand is EU consumption of permits vs EU NAP provision of permits

- Calculated as 2005 baseline
 - + economic growth (average c2.75% CAGR)
 - - general efficiency factor (average c2.5% CAGR)
 - +/- country-specific adjustment factor (CSAF)
- CSAF -1.3% allowed vs 4.1% requested so far
- Same CSAF for all countries gives a 13% cut, or 210mt shortfall vs requests
- CSAF to meet a 10% cut vs phase 1 is +2.0%, giving 155mt shortfall
- Some countries gaming, but need '06 data to be sure
- **Demand for permits is therefore at least 155 - 210mt/year from current ETS**
- Airlines could add 85mt/year demand, we assume “self-abatement”

What is the possible supply of carbon permits?

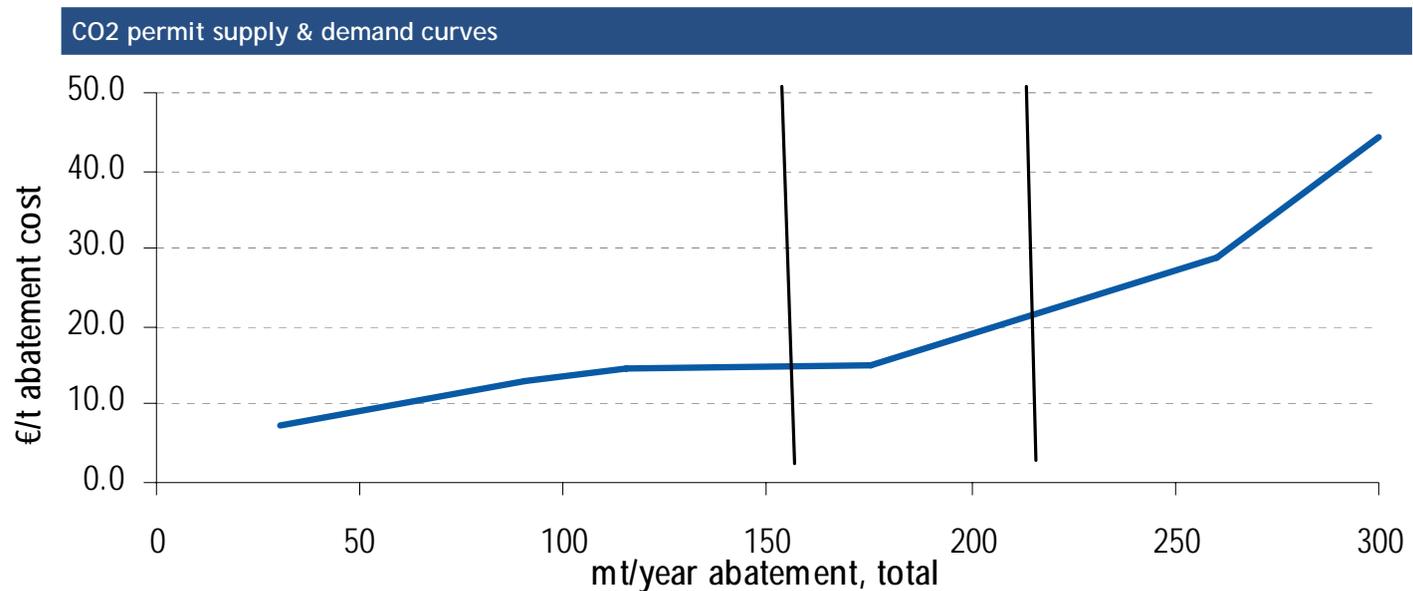
We see three broad classifications of available permit supply

- **Electricity abatement from high pollution to low**
 - UK switch from coal-to-gas
 - Germany switch from lignite-to-coal
 - Around 90mt/year of supply
- **Industrial abatement by shutting low profitability plant**
 - Cement, glass, oil refining, heavy chemicals
 - Around 120mt/year of supply
- **UN flexible mechanism permits from reducing emissions in emerging economies**
 - Around 200mt/year of supply
 - However, a large part of this (>100mt/year) could go to other schemes
 - US has emergent carbon trading schemes in California and North-East
 - Japanese government is a significant buyer of permits
 - Schemes underway in other areas including Australia and China
- **Supply therefore 300mt or more, but at a certain price**

At what price should carbon permits trade?

Break-even price for CO₂ at the top of our range for demand is c€20/t

- Supply line based on ranking of abatement and UN permits by cost
- Demand line based on our 155 - 210mt assessment
- Suggests a clearing price of up to €20/t



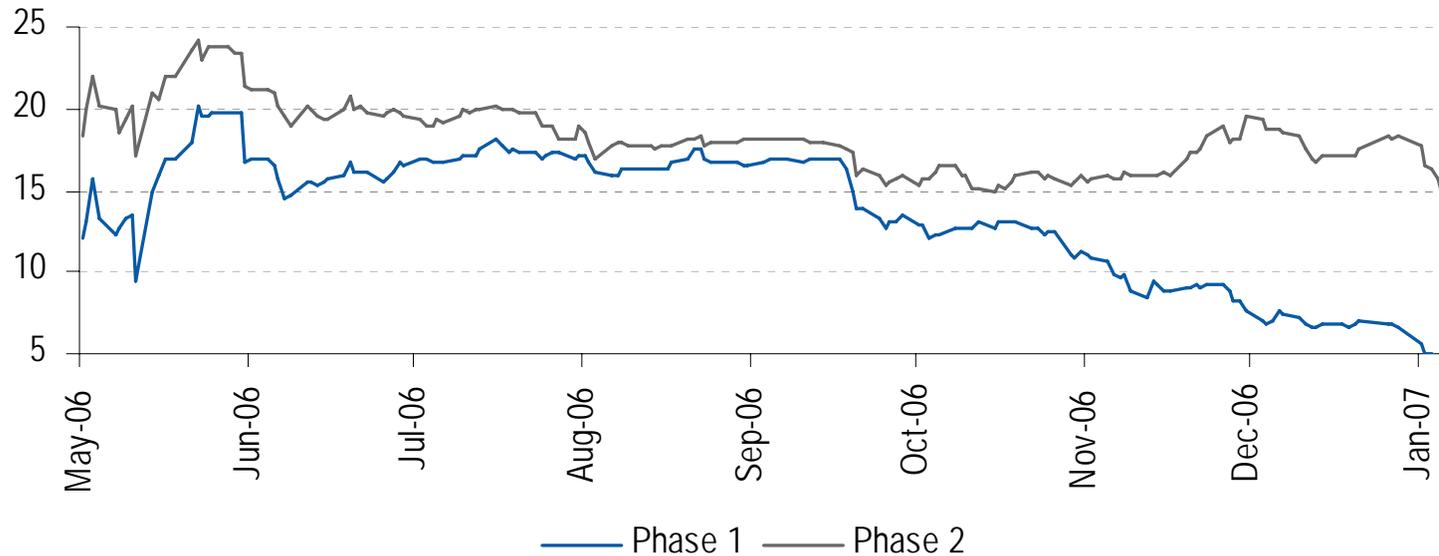
Source: JPMorgan estimates

Where are carbon permits now?

Driven by weather, commodities & its own supply/demand balance

- Phase 1 crashed given obvious over supply
- Phase 2 prices rose on expectations of the EU getting tough, fallen due to lower gas prices
- Potential for recovery in the phase 2 price to €20/t

CO2 permit prices - €/t



Source: JPMorgan estimates

What are the next events?

CO2 will continue to be a volatile commodity, with unpredictable newsflow

- Pronouncements on 8 countries due shortly
- A further 9 countries have yet to even notify the EU
- So “EU supply/demand” unknown for several months yet
- February - April see steady emergence of news on 2006 permit usage
- Steady emergence of US schemes during 2007
- November 2007 - next big UN conference to arrive at post 2012 targets?

For equity trades on our CO2 themes, please see our 14 December 2006 note

“All you ever wanted to know about carbon trading vol 4 pt 2:
Equity trades on CO2 - We like it clean”

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